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PRODUCTIVITY, COSTS AND PRICES

by ALLAN A. PORTER

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PRODUCTIVITY, COSTS AND PRICES

an examination of trends in selected manufacturing industries

by allan a. porter

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FOREWORD

This study of productivity, costs and prices brings together information in which the Canada Department of Labour has had a continuing interest for many years. It covers a number of important manufacturing industries which, for the most part, have not previously been subjected to this kind of analysis, and covers a longer time-period than has generally been used in similar studies. Although most of the analysis follows established methodology, the author has introduced concepts and techniques that are new to Canadian research in this subject area.

Almost all the data used are taken from publications of Statistics Canada (formerly the Dominion Bureau of Statistics) but responsibility for the manner in which the data were treated and for conclusions reached is entirely the author's. The findings are the author's and do not represent official Department of Labour or Government of Canada policies.

The principal author is Mr. Allan A. Porter, Chief, Wages Research Division, Economics and Research Branch of the Department. He was assisted in much of the work, especially some of the more technical aspects, by Mr. Réal Parent, formerly on the staff of the Wages Research Division, who also wrote two of the technical appendixes to this book. Professor William J. Carroll of the Department of Economics, University of Guelph, carried out valuable research for the Department a few years ago that provided a basis for some parts of the present study. The computations and preparation of tables were principally carried out by Messrs. Ken Peterson and Hans Fracke.

C.D. Harper,
Director,
Economics and Research Branch.
December 15, 1972.

Note: Because of delays in publication of this book, information is now available beyond that for 1968, the terminal year of this study. Data for 1969 and 1970 and some preliminary data for 1971 have been prepared and put into mimeographed tables. These can be obtained without charge, upon request to the Wages Research Division, Economics and Research Branch.

PREFACE

The purpose of this study is to present information on trends in the productivity of labour, unit costs of production (both labour and non-labour), the relation of both to value added at the level of the establishment, and to trends in prices. Although the emphasis in the study is on the relation of costs to value added and price movements, the author has not endeavoured to provide answers to the "demand-pull/cost-push" debate; that is, whether postwar price inflation has been caused by the pull of increasing demand or the push of increased costs. However, trend information of the nature provided can be used in many ways to analyze economic behaviour in terms of prices, wages, employment, production, and so on.

The time-period treated here is 1949 to 1968. It has the advantage of covering at least three upward and downward movements of the business cycle and of being long enough that some long-run trends can be distinguished from short-run fluctuations. It has the disadvantage of running over a period when substantial revisions were made in statistical classifications and definitions, which event caused some problems in producing a statistically continuous and homogeneous series for all the years covered. However, adjustments were made, as described in the study, that do permit use of the data as a continuous series.

Comprehensive data for any year since 1968 have only recently become available, at a time when this study was well on the way toward completion, which is the reason the time period covered ends with 1968. In any event, our purpose is to examine long-run trends based on experience over almost twenty years, and not to provide a report on the current state of the economy.

The industries studied, all of which are engaged in one form or another of manufacturing, are as follows:

Slaughtering and meat processors
Bakery products
Distilleries
Breweries
Tobacco products
Rubber industries
Cotton yarn and cloth mills
Synthetic textile mills
Clothing industries
Furniture and fixtures
Saw and planing mills
Pulp and paper mills
Printing, publishing and allied industries
Iron and steel mills
Agricultural implements
Motor vehicles
Motor vehicle parts and accessories
Smelting and refining
Electrical products
Cement manufacturers
Petroleum and coal products
Chemicals

Many of the nonmanufacturing industries, especially the service industries, cannot easily be examined for trends in productivity and costs because of the nature of their operations and the kind of data that must be used. Techniques for estimating trends in these industries are being developed and improved, however, so that we can expect such studies of these industries to become available.

As the foreword points out, this study embodies the efforts of many people. The author is especially endebted to Mr. Réal Parent for his considerable assistance and to Professor William Carroll for some of the ideas incorporated in this work, which are acknowledged in part of the text. However, the author accepts full responsibility for the study and any errors in fact or in theory that the reader may detect. Whatever may be its shortcomings, some of which are recognized in the final chapter, Chapter Eleven, the study is presented in the confidence that it adds useful information on an important subject.

Allan A. Porter

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CHAPTER ONE

The Purpose of This Study

The productivity of labour has an important influence on the demand for labour and, according to theory, the wages to be paid to labour. Changes in such productivity, divided by changes in wages, determine change in unit labour cost of production, an important component of change in product prices. Therefore, anyone who wants to examine the processes by which wages or prices are set should have information on labour productivity. Since collective bargaining is so often the social mechanism whereby wages are set, observers of industrial relations also need such information.

While the levels of and changes in wages and prices are certainly influenced by general economic conditions, the fact is that each individual wage rate and each price for a product or service is set by a firm or group of firms and, in the case of wages covered by collective bargaining, employers and unions. Therefore, the economic conditions peculiar to the particular price- or wage-fixing unit are of great importance; they include labour productivity and unit costs of production.

Most available statistics on productivity and unit costs cover either the entire economy or large sectors of it, such as all manufacturing, retail and wholesale trade, commerce, and the like. Such data, while useful in many ways, have limited value in the analysis of wage and price behaviour. While it is not feasible to produce data on productivity and costs for individual firms or other wage- or price-setting economic units (although these organizations may try it on their own with their own data), the closest approximation is statistics on industries or industry groups having, in each case, a fairly homogeneous product. Although homogeneity of output is not characteristic of every industry covered by this study, it was an important factor in choosing the industries to be covered.

There is a shortage of disaggregated statistics on productivity and unit costs, a situation that is not peculiar to Canada. Not many years ago one of the experts on productivity measurement in the United States has this to say about his country:

> "Nobody is preparing current statistics on productivity by individual industries covering a substantial number of industries. I do not know why there should be such a lack of vital statistics. We need to know more than just the average, or the figures for just a few highly aggregated industrial groups. We need to have some idea of the spread among different industries."[1]

In applying such a statement to Canada it is not meant to decry the very important work of Statistics Canada[2] which has produced some studies of labour productivity at a disaggregated level[3] in addition to its studies of broader economic aggregates; the Economic Council of Canada is conducting intensive research in this field as well; the Department of Industry, Trade and Commerce has been doing important work and in 1972 published a report, *Canadian Manufacturing Industries, Structure and Performance, with Particular Reference to Productivity*. Nevertheless, in relation to the need and size of the field to be covered, it can be said that only a beginning has been made.

Information is needed on many more industries than this study covers; somehow, measurements suitable to the increasingly important service industries must be devised. The statistics need to be kept up to date. It is regretted that the period covered here ends at 1968 but it would have caused undue delays to have taken time to introduce more recent data. On the other hand, the study covers twenty years, a longer time period than most Canadian research has tried to comprehend. To have covered the twenty years from 1949 to 1968 inclusive is no small accomplishment in view of the great difficulties in maintaining continuity and conceptual consistency over the entire period, at the level of industry disaggregation used herein. (These problems and how they are dealt with are discussed in Chapter Four.)

Aside from providing more extended industry coverage and more recent information, further studies are needed in which alternative measures of productivity and unit cost are attempted, using different definitions and factor weights than those used here. It is hoped that techniques now being developed by economists and statisticians will make it easier to estimate productivity of capital as well as labour.

It is extremely important to emphasize right at the beginning that while this study focuses on unit factor costs of production compared with prices, we are not suggesting that prices necessarily rise because of the pressure of costs. Prices

may indeed rise because of increasing costs, that is, they may be pushed up, but prices may also be pulled up by demand conditions. And prices may indeed increase in response to increasing demand even though costs are falling at the same time; conversely, it is possible for prices to decline because of insufficient demand even though costs are rising. A warning by two United States economists is worth quoting:

> "It is very important to note...that the mere possession of price and cost data does not permit us to infer the *causes* of changes in prices. There is far too much interdependence between costs and prices to permit this sort of direct inference....The mere fact that unit labour costs in industry have risen does not mean that they *caused* the price rise; we cannot say, from price and cost data alone, whether prices rose because unit labor costs rose, or unit labor costs rose because prices rose - or more likely whether the final result grew out of a combination of both causal factors. Similarly, the fact that business incomes per unit in an industry have risen gives us no warrant to assert that prices were 'pushed' up by monopolistic firms attempting to raise their profit margins. In sum, historical facts about prices and costs provide us with useful information with which to combine other information in an analysis of economic events."[4]

Our approach is to examine changes in unit costs as components but not necessarily causes of changes in price. Indeed, the changes in price may be the cause of at least some of the change in unit costs rather than vice-versa. It is not the purpose of this study to test either of these hypotheses.

The rationale followed throughout is that an index of price change is the weighted sum of the changes in individual unit factor costs of production. Because attention is focussed on productive activity at the level of the establishment (which is explained presently), it means examining price change that can be attributed to the establishment (called implicit, value-added price, as will be described presently) and the cost of factors of production in the establishment contributing to production, namely labour and nonlabour (the latter to be called the residual factor, for reasons to be explained). In the case of unit labour costs, their components, namely changes in labour productivity and in wages paid for labour, are examined; this kind of disaggregation is not possible with unit residual costs (as will be explained). The relation of price at the level of the establishment to end-product price is briefly examined because it is, after all, the wholesale or retail price with which the general public is concerned.

In short, with respect to the manufacturing industries examined, and on the basis of annual data from 1949 to 1968 inclusive or, in some cases, from 1961 to 1968, at least partial answers are provided to these questions:

1. What have been the trends in the productivity of labour?

2. How do trends in total compensation per worker (wages and fringe benefits) compare with trends in labour productivity, and what has been the result for unit labour costs?

3. How do trends in nonlabour unit costs of production (unit residual costs) compare with unit labour costs?

4. What have been the trends in prices and how do trends in unit labour and unit residual costs compare with them?

5. As a result of differential movements in unit costs, what has happened to labour's share of total income from production? In other words, what has been the trend in labour's relative rate of return?

There should also be a clear understanding about what this study does not reveal. It does not explain why labour productivity has been increasing or decreasing or why it is changing at the rate indicated; it cannot reveal how much of the change in unit residual cost can be attributed to a change in price of residual input and how much to a change in residual productivity; it does not indicate why price has moved up (or held steady or declined), be it in response to increased demand or rising costs.

Since qualifying warnings are here in order, it is well to quote part of a statement in a foreword to a recent Statistics Canada publication that also applies to the concept of productivity used here:

> "It must be emphasized...that changes in output per unit of labour input cannot be attributed directly and solely to labour. These measures reflect not only changes in the skills and effort of the labour force, but also the contribution of other productive resources with which it works, as well as the effectiveness with which all are combined and organized for production. In other words, changes in technology, capital investment, capacity utilization, workflow, managerial skills and labour-management relations each have a bearing...."[5]

Footnotes

[1]Solomon Fabricant: *Measurement of Technological Change*, U.S. Department of Labor, 1965; page 21.

[2]Statistics Canada is the name of what, until August 1971, was known as The Dominion Bureau of Statistics, the central statistical agency of the Government of Canada. References to and citations of reports of this agency mostly use its earlier name because that is the name appearing on most publications used or cited in this study.

[3]They include reports on productivity trends in synthetic textile mills, breweries, pulp & paper mills, iron & steel mills, cement manufacturers, and petroleum refineries. These reports are cited in detail in parts of this study.

[4]Charles L. Schultze and Joseph L. Tryon: *Prices and Costs in Manufacturing Industries*, Study Paper No. 17, Joint Economic Committee, United States Congress, 1960; pages 8-9,

[5]Dominion Bureau of Statistics: *Productivity Trends in Industry*, Report No. 2, Iron and Steel Mills (Catalogue No. 14-503) Feb. 1970.

CHAPTER TWO

Productivity Defined and its Measurement Explained

Standard definitions and measurements of productivity are used here. The reader who is familiar with the literature on productivity measurement will find nothing new. Therefore, our explanation of definitions, concepts and methods of measurement is, by and large, limited to what is necessary for an understanding of the data. Reference to alternative definitions and measurements of productivity, etc. is limited to what is considered necessary for a description of the scope and limitations of the research findings.

The notion of productivity always seems to be associated with some controversy and confusion. The confusion and probably much of the controversy arise over the fact that different measures are appropriate for different purposes. Nevertheless, one aspect of the productivity concept holds true in all cases. Essentially, productivity is a ratio of units of output to units of input (labour, capital, energy, raw materials, etc.). Here are two definitions from authoritative sources:

> "Fundamentally, productivity is a measure which expresses the relationship between output and the resources utilized in its production. More precisely, it is the ratio of output to a single input or to a combination of inputs. For instance, the volume of output per man-year or per man-hour, the number of bags of potatoes per acre, the tonnage of aluminum per kilowatt hour of energy, the number of tires per machine-hour, or ton-miles or passenger-miles per man or per unit of equipment, are all expressions of productivity. Each of these ratios is a measure of performance, relating the volume of output realized to the volume of resources used."[1]

> "In concept, productivity is always a ratio of output to input, and a productivity index is always the ratio of one period (or place) relative to the corresponding ratio for another period (or place)"[2]

A finished product embodies the combined contribution of all the factors engaged in its production. These factors are not only labour and capital but also raw materials, fuel and energy, and other less tangible resources such as management and organization (which, under some definitions, would be included with capital). And this is where the intended purpose of the productivity measurements makes all the difference. If the purpose is to produce some kind of measure of general economic efficiency for the entire economy, a large sector of the economy, an industry or even a particular firm, it is necessary to have a measure of total factor productivity; that is, to determine the required amount of each factor that is used, the relative cost of each factor in relation to total input cost, and to measure changes over time in the relative utilization (that is, the proportions used) of the factors in relation to increases or decreases in total output. Such a measure is difficult to produce because of limitations in the data that are available, and most studies use partial productivity rather than total factor productivity measurements, and relate changes in total output to changes in the utilization of a particular type of input. The most commonly used factor for this purpose is labour, so that the distinction between partial and total productivity is more fully explained in the following:

> "The term 'productivity' is generally used rather broadly to denote the ratio of output to any or all associated inputs in real terms. 'Real' refers to output in physical rather than value terms. Ratios of output to particular inputs may be termed 'partial productivity' measures, the most common of which is output per manhour. Partial productivity ratios, while useful for measuring the saving in particular inputs achieved over time, do not measure over-all changes in productive efficiency, since they are affected by changes in composition of input, i.e., by factor substitutions."[3]

Aside from the difficulties of constructing measures of total factor productivity, a partial productivity measure, such as labour productivity, is the most suitable when the purpose of the analysis is to compare labour's contribution to output with the contribution of other inputs, chiefly capital; labour productivity is the relevant measure for analysis of the relation of productivity to wage levels and wage changes.

We have already distinguished partial from total productivity measures. Two other distinctions can be made, one between measuring levels of, compared with rates of change in productivity; the other, physical as compared with value productivity.

Levels of productivity can be expressed as the number of bricks laid by a bricklayer in an hour, the amount of steel that can be produced with an hour of labour time, yards of cotton textiles per manhour, and so on. Each measure expresses a ratio between a physical quantity of output and the number of workers or manhours required to produce it, this measure reflecting the situation at a given point of time. If reliable data are available, it is possible to use such measures to compare productivity between steel mills, for example, where output per worker, measured by tonnage of steel, can be used for comparison. (Obviously, in such a comparison the kind of steel being produced must be the same and there must be no other differences that would invalidate the comparison.) But productivity measured in this way has a serious limitation in that it is quite impossible to compare, in terms of physical units of output per worker or per manhour, the productivity of a steel mill and a textile mill. Only if the output of each mill is expressed in value terms can such a comparison be made. While it is impossible to compare tons of steel with yards of textiles per worker, it is possible to compare the dollar value of production between the one type of establishment and the other. A value productivity measure would be useful where a physical measure would not.

Most measurements of productivity concern change over a period of time rather than absolute levels at a given point in time. Economic analysis that is concerned with rates of changes in prices, wages or returns to factors of production is also concerned with rates of change in productivity and not with the absolute level of productivity at a given point in time. Our interest here is in rates of change rather than absolute or relative levels. (An attempt to explain interindustry wage differentials at a given point in time by differences in productivity requires comparisons of relative levels of productivity and must be of value rather than physical productivity.)

This study is, then, concerned with measuring change in partial productivity, in this case, labour productivity. However, it is not changes in value productivity that are being measured but changes in "real" productivity. This may not be quite the same as physical productivity but is the closest possible approximation. Each productivity index measures changes in total output produced by a given amount of labour input in the industry in question, that output consisting of a large variety of different kinds of product that are combined in different proportions each year.[4]

It is easy enough to compile data on total value of production from one year to another and measure changes in that value. It is less easy to translate that into "real" changes in production when the product-mix is varied and changes from year to year. However, this must be done if changes in real labour productivity (i.e., real output per worker or manhour) are to be measured. This calls for a technique whereby increases in money value are deflated to allow for increases in unit price or unit money value. How this is done is described briefly in Chapter Four.

The statistical measure used in this study is an index of labour productivity, that is, an index of change in "real" output per worker or per manhour. Symbolically, it can be expressed as follows:

$$\frac{Y}{L}$$

where Y is an index of change in output and L is an index of change in quantity of labour employed.[5]

The productivity of a factor, be it labour or anything else, can increase for a variety of reasons, some of them being:

(1) increased effort of the labour force,
(2) more efficient management and utilization of labour,
(3) the application of new methods and/or capital equipment.

These three factors include better job design, better plant layout, improved design of the product that renders it easier to produce. The converse of these and similar circumstances might explain decreasing labour productivity.

When we consider an entire plant (establishment), firm or industry (or group of industries), productivity may increase (or decrease) not only for the reasons just mentioned, but for other reasons as well, including:

(1) changes in the skillmix of the labour force (which, other things being equal, assumes that if skills are increased, higher productivity follows),
(2) Changes in product mix (from low to high productivity items or vice-versa if there is a net decline in productivity), and
(3) the opening up of new plants or operations or closing down of old ones.

The productivity indexes used here measure the net result of all these factors (and others that have not been mentioned) and the efficiency with which the labour resource is used. Research in depth would allow for at least some of the factors and while such research is not attempted here, a brief reference to some of the factors follows.

One measure weights labour inputs in such a way as to hold constant the effect of changes in skill mix on total industry productivity.[6] If a certain rate of productivity (that is, a level of output per worker at a point in time) can be attributed to each type of skill employed in an establishment and even if these rates do not change, if the use of some of the more productive skills increases relative to some of the less productive, there will be a net increase in labour productivity in that establishment. For some purposes, this is taken to be a genuine increase in labour productivity, but for other purposes it is not. The technique that is suggested for eliminating the effect of changes in skill mix is to weight the aggregate labour input (preferably manhours but number of workers if manhours data are not available) by the relative wages paid for each type of labour in the base year. It is assumed that the wage paid in each case properly reflects the degree of skill of that job, which is why relative rather than absolute wages can be used, that is, figures representing the differences between wages that are purported to represent actual skill differences. This kind of index of labour productivity, where the labour input is modified to allow for changes in skill mix, can be expressed symbolically as follows:

$$\frac{Y}{L^*} = \frac{y_1 / y_0}{\sum_i^n l_{j_1} w_{j_0} \Big/ \sum_i^n l_{j_0} w_{j_0}}$$

$$j = 1 \ldots\ldots\ldots n$$

where L^* represents the modified index of labour input, with l_{j_1} / l_{j_0}

representing the change in the employment of labour in the jth skill group in period 1 over the base period, the relative skill level of l_{j} being fixed at its base-period value as weighted by its relative wage $\left(w_{j_0}\right)$ at that time.

The difference this modification can make is illustrated by a hypothetical situation in which the entire increase in labour productivity can be attributed to changes in skill mix. Assuming an index of output of 125 (meaning a 25% increase in the current period over the base period) and that total labour employed has not increased, meaning that the index of labour is 100, the index of labour productivity would be 125, meaning a 25% increase in output per worker. If, however, skill mix has so changed as to produce a weighted labour input index of 125, it can be seen from the following that labour productivity has not increased at all:

$$Y = y_1 / y_0 = 125$$

$$L^* = \left(\sum_i^n l_{j_1} w_{j_0}\right) \Big/ \left(\sum_i^n l_{j_0} w_{j_0}\right) = 125$$

$$\therefore \frac{Y}{L^*} = \frac{125}{125} = 1$$

Expressed as an index this is 100, meaning no change.

Such a measure can be useful where the purpose is to ascertain the extent to which existing skills are being used more effectively, or, put another way, to measure the increase in productivity of a group of workers of specified skills. It has also been pointed out that this is probably the most useful measure of productivity in the analysis of wage determination:

> "If the use of the productivity measure is in wage analysis, negotiation, or determination, the appropriate productivity concept is not output per unit of total input. Instead, it is output per man-hour and, particularly, output per weighted man-hour."[7]

However, the primary purpose of our productivity measure is to provide a basis for studying trends in unit labour cost which can be compared with unit residual cost and price movements, and for this purpose modification of labour input to allow for changes in skill mix would not be appropriate.

A measure of labour productivity using an index of labour input unweighted for skill is appropriate when it is intended to indicate how much productivity has increased (or decreased) as a result of the use of all factors of production. Thus

efficiency, in the allocation of labour resources (which might explain an enrichment of the skill mix) is taken into account along with all other factors.

Even where an index of labour input modified for changes in skill-mix is appropriate, the use of relative wages for the weights is questionable. To assume that relative wages reflect relative levels of skill may be acceptable within an industry (although even this is questionable) but it breaks down seriously on an interindustry basis where differences in aggregate productivity and rates of profit can make for substantial wage differences only slightly (if at all) related to skill differences.

Just as changes in the relative quantities of skills employed can account for at least some of the changes in labour productivity, so changes in the relative importance of establishments in an industry can affect the net productivity index for that industry. By assigning a fixed weight to each establishment based on manhours devoted to its product in the base year, it is possible to construct labour productivity indexes for an industry that are unaffected by changes in the relative importance of plants with high or low output per manhour.[8] It has not been possible for us to make this kind of adjustment which is used by the United States Bureau of Labor Statistics in some of its productivity series, nor is another modification proposed by the same BLS economist. He has suggested that in combining indexes of productivity by product to produce a productivity index for an industry, it is best to weight those indexes by manhours. "...because such a weighting system results in a measure which is a weighted average of indexes of physical productivity for the separate products."[9] In any event, our purpose is not to measure "pure" changes in productivity, which is the purpose of the suggested modifications, but rather to examine the net result of these many movements as reflected in changes in labour productivity and unit costs of production at the industry level.

Various other modifications of or alternatives to the productivity measures used herein are described in the literature that has been cited. Most of the modifications consist of alternative weighting of input or output indexes for the purpose of holding certain factors constant. When indexes or absolute values are aggregated or averaged, some kind of weighting is essential but there must be consistency among the measures as to what weights are used so that the same factors are held constant in every case. The problem did not arise in our research because we did not try to aggregate the individiual measures of productivity, which measures are based on aggregate data produced by Statistics Canada.

While the problem of weighting does not occur here, it is so important to the comprehension of productivity statistics that a few more words are in order. Where data on inputs and outputs are combined from separate sources in the process of aggregating or averaging them, it is probably necessary to assign a weight to each separate measure of input or output to reflect its importance in relation to the whole. In preparing measures of labour productivity, the choice of weights depends on how closely it is hoped to measure "pure" change in productivity; it may also be intended, by the application of various weights in succession, to estimate the influence of different factors on labour productivity. Something of this kind was done by Dr. Kendrick in his estimates of productivity trends in the United States. He estimated that between 1889 and 1957 physical output per manhour in the private sector increased by about 2.4 percent per annum; if highly paid manhours are weighted proportionately higher than lower paid ones, the annual growth rate is reduced to 2.0 percent, and if allowance for capital as well as labour input is made, each weighted by its market value, the growth rate is further reduced to about 1.7 percent.[10]

Estimates of the contribution to Canadian Labour productivity of changes in the age-sex composition and educational attainment of the labour force have been made, as well as the effect of the reallocation of labour and other resources from less to more productive use.[11] Such computations require the collection, interpretation and application of data suitable to these purposes, weighting them appropriately to allow for their contribution to the final product.

This kind of intensive, analytical research is essential to any study of the net efficiency of the economy and the forces determining the distribution of factor shares of gross national product. Ultimately it is hoped that analysis of this sort can be applied to discrete industry groups and even specific industries at a highly detailed level of disaggregation. But for the present these techniques are more suitable for macroeconomic analysis.

The basic statistical data used for this project are described in Chapter Four. However, this chapter on the measurement of productivity can most appropriately close with a brief consideration of the kinds of data needed for the measurements that have been described.

Because productivity is a ratio between units of output and of input and unit cost is itself a ratio between productivity and the purchase price of the input (which is discussed further in the next chapter), the selection of data for each of these values is of central importance. The data must pass the test of the following criteria:

(1) they must be consistent over time and cross-sectionally at a point in time so that analysis of trend and any comparison of productivity among industries or other economic aggregations is possible;

(2) they must be suitable for combination or comparison with other measures;
(3) where they represent a combination or averaging of values, they are based on weights that accurately reflect the relative importance of each component.

To put this into an example: an index of productivity in the cotton textiles industry should use data covering, for the entire period, those establishments (no more and no less) that are assigned for statistical purposes to the industry because their output constitutes the classes of goods that are classified as cotton textiles. Changes over the years in the nature of output must be accounted for, including the disappearance of some kinds of product and the emergence of new kinds, so long as they are consistent with the description of the industry. Interindustry comparisons require that there be no overlapping or duplication of kinds of output among the industries whose productivity is being compared.

To produce an index of labour productivity in the cotton textiles industry requires that the measure of labour input which is divided into a measure of output must reflect all of the labour (allowing for certain possible exclusions) engaged in production of the output. (Of course, if it is an index of production worker productivity, then only production labour is accounted for and salaried employees are not counted as part of the labour input.) Similarly, calculation of unit labour cost requires that the payroll data (total wage bill) be the entire amount payable to the workers comprising the labour input.

Footnotes

[1]D.B.S.: *Indexes of Output Per Person Employed and Per Man-hour in Canada Commercial Nonagricultural Industries, 1947-63,* (Catalogue No. 14-501), 1965; page 33.

[2]Solomon Fabricant: "Which Productivity? Perspective on a Current Question", *Monthly Labor Review,* June 1962, pages 609-610.

[3]John W. Kendrick: *Productivity Trends in the United States,* National Bureau of Economic Research, General Series No. 71, 1961; page 6.

[4]For detailed analysis of the measurement of productivity see International Labour Office: *Measuring Labour Productivity* (Studies and Reports, New Series, No. 75), Geneva, 1969; and Organization for European Economic Co-operation: *Productivity Measurement, I, "Concepts",* 1955.

[5]Capital letters are used throughout this study to stand for indexes of change, while lower case letters represent absolute or current dollar values at a given point in time. Thus, L represents a change in the employment of labour in a given year compared with the base year, while l represents number of workers employed in a given year. In other words, L = li/lo, where li represents actual numbers of workers employed in the reference year and lo represents employment in the base year.

[6]J.W. Kendrick: op. cit., page 31; H.A. Turner and H. Zoeteweij: *Prices, Wages and Incomes Policy,* International Labour Office, Geneva, 1966, pages 115-116.

[7]Solomon Fabricant: "Which Productivity? Perspective on a Current Question", *Monthly Labor Review,* June 1962, pages 610-611.

[8]See Allan D. Searle: "Relationships Between Productivity Measures", *Monthly Labor Review,* May 1954, page 553.

[9]ibid., pages 552-553.

[10]John W. Kendrick: op. cit., Introduction.

[11]Dorothy Walters: *Canadian Income Levels and Growth - An International Perspective,* Staff Study No. 23, Economic Council of Canada, 1968; N.H. Lithwick: *Prices, Productivity, and Canada's Competitive Position,* Private Planning Association of Canada, 1967.

CHAPTER THREE

Value Added, Unit Costs, and Implicit Price

The economic unit whose activities are examined here is the establishment, meaning, for purposes of this study, a plant or factory, sometimes a warehouse. While the statistics are presented by industry, they reflect the net result of the combined productive activities of the establishments constituting each industry.

An establishment receives raw materials or partly processed materials that come from outside. An establishment also receives fuel and electric power that are required for its manufacturing operations that also come from outside. The raw or semi-finished materials and the energy sources (fuel oil, coal, hydro-electric power, etc.) are prepared elsewhere, in other establishments, be they mines, smelters, power stations, refineries, etc.

In processing the materials brought in from outside, energy powers the machinery and other equipment operated by the workers in the establishment. The application of labour and capital equipment in the plant transforms the raw materials into a finished product or into semi-finished form, for further processing in another plant. For example, steel may be brought into a plant in some form and made into nuts and bolts, a finished product, or into sheet metal, a semi-finished product ready for use elsewhere in the manufacture of stoves or refrigerators.

The point is that the establishment processes the raw materials, producing something having greater economic value than the materials had when they arrived at the plant. The additional value that is created is called value added and is the direct result of the efforts of the labour force making use of the machinery and other facilities of the plant.[1]

Essentially, there are two factors of production peculiar to the establishment (as opposed to materials and energy, which are factors brought in from outside), namely, labour and capital. The latter would have to include not only plant (the actual building and its facilities) and machinery but the land where the plant is situated and less tangible things such as research and testing laboratories, other ancillary services (to the extent that the services themselves can be distinguished conceptually from the labour that performs them) as well as plant layout and even the organization of the company. Whether some of the things just mentioned constitute capital is debatable. For this reason, among others, the notion of capital is not used in this study; instead, the references are to labour and the non-labour or residual factor.

Another compelling reason for using the concept of a residual factor is that it is very difficult to measure what capital consists of at a point in time, which is not so in measuring labour input. In addition to physical capital there is financial capital which reflects in part the market value of the physical capital, but consists not only of the equity of the owners of the plant but also of working capital, stocks of inventory, etc. While profits are a return to capital and not part of it (except as accumulated profits become a reserve of financial capital), they are part of the residual item because it is not possible to separate the various components of the residue which, combined with the payroll for labour, constitute value added.

Because of these complexities, we have not tried to measure these various kinds of capital or their productivity. What is known and measured is value added and its components, which are labour cost and residual cost. It is possible from available data, to measure not only value added, which is a current dollar measure of the economic contribution of the establishment, but also real output per worker (that is, labour productivity) and labour cost and residual cost per unit of real output.[2]

A distinction has already been made between physical and value productivity. Value added is expressed in current dollars while data on real output purport to measure the "real" equivalent of value added. Processing raw material does something physical even if the establishment only carries the operation part of the way to completion of a finished product; it definitely adds value which has a physical or "real" as well as a monetary dimension.

The methodology followed here is to examine the labour and residual components of value added. With a measure of real output as the denominator, it is possible to produce ratios of value added and labour and residual cost per unit of real output. It is also possible to derive from ratios of output to labour input a measure of labour productivity although, for reasons already given, it is not possible to do this for residual input.

An index of unit labour cost measures the change in the amount of money that must be paid for the quantity of labour required to produce one unit of real output. Since, with the passage of time, the amount of such labour may increase or decrease, and similarly its price (that is, the wage rate), it follows that change in unit labour cost is a function of the change in labour productivity and the wage rate per unit of labour.

The formula for labour productivity has been given as Y/L where productivity is expressed as changes in units of output per unit of labour input. If W represents change in the total wage bill, then change in wage per worker is W/L. Therefore, change in unit labour cost is:

$$\frac{W}{L} \Big/ \frac{Y}{L} = \frac{W}{Y}$$

which represents change in the wage paid to a unit of labour in relation to the change in output produced by that amount of labour input.

While productivity for the residual input cannot be estimated, trend in residual cost per unit of output is computed the same way as for unit labour cost, represented by R/Y where R represents change in total outlay for residual input.

Thus, indexes of change in labour requirements per unit of output (the converse of labour productivity), unit labour and unit residual costs are computed by dividing respectively indexes of labour employed, total wages paid, and total residual payments by the index of real output. Similarly, if the index of value added is divided by the index of real output, the resulting measure is an index of value added per unit of output.

It has already been explained that value added comprises the sum of payments for the labour and residual inputs. It is expressed in this simple identity:

$$w + r \equiv va$$

where va represents value added at a point in time.[3]

It might be assumed from this that:

$$\frac{W}{Y} + \frac{R}{Y} = \frac{VA}{Y}$$

which would mean that the index of unit labour cost plus the index of residual cost equals the index of value added per unit of output. However, in the case of index numbers, this is not true in the form expressed in the equation. For one thing, index numbers rather than absolute values are being added, and while the sum of the current dollar values of labour and residual costs is equal to value added, this does not mean that index numbers of these costs can be similarly added. Index numbers can be added but, since all indexes start from a base of 100, even if each index represents no change from base period values (which are represented by 100), the sum of (W/Y) + (R/Y) is 2, while VA/Y has a value of only 1; (W = 100, Y = 100; therefore, 100/100 = 1; similarly with R/Y and VA/Y). This is because when weights are not specifically assigned to a value in an equation, it is implicit that each value has a weight of either one or zero, meaning in this case, a weight of one since a zero weight would be inconceivable. The sum of the indexes of unit labour and unit residual cost can only equal 1 where the sum of the weights of these values equals unity. In fact, the sum of the weights must come to unity, whatever the value of VA or VA/Y. If (W/Y) + (R/Y) = 2, it cannot equal VA/Y which has a value of 1.

If $w + r \equiv va$, it follows that $(w/va) + (r/va) \equiv 1$, and that $r/va = 1 - (w/va)$. It can be concluded that:

$$\frac{W}{Y}\left(\frac{w}{va}\right) + \frac{R}{Y}\left(1 - \frac{w}{va}\right) = \frac{VA}{Y}$$

which means that the index of value added per unit of output is the weighted sum of the indexes of unit labour and unit residual cost, the weights being respectively the proportion of labour payments and of residual payments to value added. With W/Y (index of unit labour cost) and the labour cost ratio, w/va, being computed, R/Y was computed by the formula

$$\frac{R}{Y} = \frac{VA/Y - W/Y\left(\frac{w}{va}\right)}{\left(1 - \frac{w}{va}\right)}$$

(This is discussed further in Chapter Nine.)

An index number by its nature expresses the percentage difference (as a multiple of 100) between the value for the reference or current year and the base year; if that index number is weighted, the weights must be derived from actual values in a particular year. It is usual practice to select the base or original year, which has been done in this study. An alternative is to use current weights, which in this case would be the proportion of labour and residual payments to value added in each year for which the index is constructed. This means that the weights would change for each year. The merits of base versus current weights have long been debated among experts, and this report offers no contribution to that debate. Base weights

are used in this study, partly because it is the most common practice, but the principal reason is that base weights hold constant the proportions of payments to labour and the residual factor, which is more suitable to analysis of long-run change than the use of current weights. It also happens that the base-weighted index of unit labour cost divided by the index of implicit price (that is, value added per unit of output) produces a result that is equal to the current weight, that is, the current-year ratio of labour payments to value added.[4] This makes it possible to check the accuracy of the measurements because if the base-weighted index of unit labour cost, divided by the implicit price index (index of value added per unit of output) produces a result different from the current ratio of labour payments to value added, there is evidence of a mistake in the calculations.

The index of value added per unit of output, that is, VA/Y, has just been called an implicit price index. This is because it measures change in what has been called value-added price; in other words, it measures change in the monetary component of unit value added, as compared with the physical dimension to value added. As will be seen in the next chapter, indexes of real output serve to measure the change in this physical dimension of value added. The implicit price index or index of value added per unit of output measures the value component.[5]

Because the concept of implicit or value-added price has not been used to any great extent in Canadian research on productivity and unit costs of production, reference to some authoritative statements on the concept is appropriate at this point. A concept of this kind, although not described in these terms, was employed in a study carried out for the Canada Department of Labour.[6] Dr. Charles L. Schultze has made considerable use of this concept in his work and describes its significance quite well in these statements:

> "It should be noted that the indexes explained above are not ordinary price indexes for the goods produced by an industry. They are calculated from the value *added* in an industry, and are therefore indexes only of the costs *originating* in the industry. The cost of raw materials, fuel, and anything else purchased *outside* the industry are not reflected in these indexes for they are neither part of the returns to the factors used in the industry nor indirect taxes levied on the industry. Hence these indexes may move differently from a price index of the prices charged for goods produced by the industry. The ordinary price index reflects the behavior of all costs and not just those originating within the industry in question. Conceptually the price (or total unit cost) which we have calculated is equal to the market price of the product minus the unit cost of raw materials and supplies purchased from other industries. In the discussion in the remainder of this paper...the term price will be used in this special sense of total unit cost of the product originating *within* a given industry."[7]

> "Division of the current by the constant dollar gross output yields an index of the average price of gross product in each industry. Since product has been defined as the sales of the industry minus its purchases from other industries, this price index is somewhat different from those to which we are normally accustomed. In concept, it is literally the price of output originating in the industry - its sales price minus the unit cost of materials and services purchased from other industries."[8]

Elsewhere Schultze says that "Value-added price...is simply the total value added divided by production, i.e., it is value added per unit of output. As the sum of component factor costs per unit rises, the value-added price will also rise."[9] The United States Bureau of Labor Statistics includes an "implicit price deflator", defined as "current dollar gross product divided by constant dollar gross product" and an index of "unit nonlabour payments" (including profits and depreciation, interest, rental income and indirect taxes) in its reports on productivity, wages and prices. Conceptually these measures resemble our measures of implicit (value-added) price and unit residual cost although they differ in many details.

Finally, there is this reference to the concept by an economist of the United States Bureau of Labor Statistics:

> "The difference between the undeflated output and input values (value added), when divided by the difference between deflated output and input (real value added), yields an implicit index of value-added price or of unit-value added."[10]

Credit for introducing the concept into this study goes to Professor William J. Carroll whose study, prepared for the Canada Department of Labour, is mentioned in the Foreword.

Footnotes

[1]More complete definitions of value added, as employed by Statistics Canada, and of other terms applying to the basic statistical data, appear in Chapter Four.

[2]How real output is estimated, including a description of the estimates, appears in Chapter Four, along with other descriptions of the statistical data that are the basis of the measures prepared for this study.

[3]It will be recalled that lower case letters represent absolute values at a given time, while capital letters represent indexes of change over time.

[4]This is demonstrated mathematically as follows:

$$\frac{W}{Y}\left(\frac{w_0}{va_0}\right)\cdot P^{-1} \qquad \left[P=\frac{VA}{Y}\right]$$

$$=\frac{\frac{w_1/w_0}{y_1/y_0}\left(\frac{w_0}{va_0}\right)}{\frac{va_1/va_0}{y_1/y_0}}$$

$$=\frac{w_1\, y_0\, w_0\, y_1\, va_0}{w_0\, y_1\, va_0\, y_0\, va_1}$$

$$=\frac{w_1}{va_1}$$

[5]VA represents the index of value added, Y represents the index of real output (or production, as it may be called); VA/Y represents the index of value added per unit of real output (or output, for short), which is also an index of value added or implicit price, represented by P. Therefore, VA/Y = P, and P x Y = VA.

[6]Noah M. Meltz: *Changes in the Occupational Composition of the Canadian Labour Force, 1931-1961;* Occasional Paper No. 2, March 1965, Canada Department of Labour, page 124.

[7]C.L. Schultze and J.L. Tryon: *Prices and Costs in Manufacturing Industries,* Study Paper No. 17, Joint Economic Committee, United States Congress, 1960, pages 6-7.

[8]C.L. Schultze: *Prices, Costs and Output for the Postwar Decade, 1947-1957,* The Committee for Economic Development, 1959, page 16.

[9]C.L. Schultze and J.L. Tryon: "Prices and Wages", Chapter Nine in James S. Duesenberry et al. (ed.'s): *The Brookings Quarterly Econometric Model of the United States* (Rand McNally), 1965, page 282.

[10]Allan D. Searle: "Toward Comprehensive Measurement of Prices", *Monthly Labor Review,* March 1971, page 15.

CHAPTER FOUR

The Basic Data - A Description, Analysis and Evaluation

The purpose of this study, the essential concepts and methodology, have been set forth in the preceding chapters. Our next step is to describe the raw data that were used, and how they were adapted to the purpose at hand.

Much of the methodology and rationale of the study is, as pointed out in Chapter Three, embodied in this equation:

$$\frac{W}{Y}\left(\frac{w_0}{va_0}\right)+\frac{R}{Y}\left(1-\frac{w_0}{va_0}\right)=P \text{ where } P=\frac{VA}{Y}$$

R/Y (index of residual cost) is derived algebraically, as described in the previous chapter.[1] What is needed, therefore, is basic data for the other values:

W - index of total payroll paid to the labour force;
Y - index of real output or production,
VA - index of value added.

It happens that published indexes of real output, suitable to present purposes, are available, but this is not so for W and VA. However, absolute measures for w (payroll in a given year) and va (value added in a given year) are available, and since W represents w_1/w_0 and VA, va_1/va_0 the indexes can be produced. From this information it is also possible to calculate the base-year labour share $(w/va)_0$ which is used as a weight in the equation shown above.

Equally essential to this study is the analysis of trends in labour productivity which is expressed as Y/L where L is the index of labour employed. While indexes of employment are published, none of them are entirely suitable to the present purpose but suitable figures on actual employment are available, and index numbers were computed from them.

The task immediately at hand is to describe the data used for w, l, va, and Y, to discuss the relation of the separate series to each other, their comparability, and any adjustments that may be necessary so that they can be added together, subtracted, multiplied, divided or subjected to other mathematical operations where comparability and consistency are essential.

If these various kinds of data came from different sources and were collected in different ways, the problems of comparability and consistency could be considerable. Fortunately, this is not so. The primary source of all the basic information on both inputs and outputs is the annual Census of Manufactures carried out by Statistics Canada. The group responsible for this census, the Manufacturing and Primary Industries Division, produces the annual reports containing current dollar value of output (a gross measure showing selling value of factory shipments, a net measure showing value added), total wages and salaries, cost of raw materials and of fuel and energy; data on some inputs and outputs are also shown in physical terms (volume or weight, numbers of pieces produced, etc.). This unit does not produce any index numbers but the indexes of real output (index of industrial production, index of real domestic product), produced in the Industrial Output Section, National Output and Productivity Division, are based on the current dollar values and physical input and output data compiled from the annual Census of Manufactures.[2]

The units just described are the source of the basic data that enter into the measures of labour productivity, unit costs, and price movements. In addition, information from other sources is used to supplement, or for comparison with, the basic measures: data on prices from the Prices Division and on employment, weekly wages and salaries, and average hourly earnings from the Labour Division of Statistics Canada. Use is also made of occupational wage rate data prepared in the Canada Department of Labour, Economics and Research Branch. This information is described where it is used. The balance of this chapter is concerned with the basic data.

The data obtained from the Census of Manufactures are described only to the extent necessary to explain how they were used in this project; the reader's attention is directed to Statistics Canada publications for fuller datails.[3] It is worthy to note that, as its name implies, the Census of Manufactures covers all manufacturing establishments; it does not exclude smaller

establishments (usually those having less than 20 employees), which is the case with some of the other surveys, especially those that are conducted once a month or at least more than once a year.

Among other things, the annual census obtains information on number of workers employed and since 1961, manhours paid for in the case of production workers. Employment is divided into four categories: production and related workers, manufacturing activities; production and related workers, nonmanufacturing activities; administrative and office employees; sales and distribution workers. In this study we examine employment by two categories - production worker employment and total employment, the latter comprising production workers and those called salaried employees. The employment data are adjusted by Statistics Canada to allow for the effect of part-time or seasonal employment.

Employees classified as production workers, manufacturing activity, are sometimes described as "direct" labour, while those in the other (nonmanufacturing) categories are called "indirect" labour. "Usually, the concept of direct labour covers any labour directly connected with production, while indirect labour covers labour not directly on production but essential to the operation of the establishment."[4]

Separate data on employment of production workers, manufacturing are used here because measures of labour productivity and unit labour cost have been based on such a labour input. Production worker productivity is commonly found in productivity estimates and it is an easily understood concept because the labour input is directly related to the output, hence the notion of direct labour. Similarly, data on total employment (excluding working owners and partners) were used as the basis of other measures of labour productivity and unit labour cost because it is obvious that indirect labour makes a contribution to output, as does direct labour. However, separate data on the groups of workers constituting salaried employees were not used because measurement of the productivity and unit labour cost to be attributed exclusively to the nonproduction labour force is more difficult conceptually and is hampered by a lack of suitable data.[5] Employees in head offices have been excluded from all our employment data; because such data are not available for some of the industries covered here, they are excluded for all the industries to permit consistency.

Data on employment, expressed as numbers of workers or employees, have been consistently available for the complete time-period covered by this study. However, data on manhours paid for have only been available since 1961. (Information of this kind has been available for several years from the monthly Survey of Employment, Payrolls and Manhours, but the data are on a different basis from those in the Census of Manufactures and are not sufficiently comparable.) Where manhours are used, it is important to remember that the data represent hours paid for, not hours worked; the former, in addition to hours worked, include hours paid for but not worked, chiefly for paid holidays and vacation time. Of course, where an hour worked happens to be overtime and is paid for at twice the normal rate (for example), the hour is still counted as one, not two hours.

The employer's money outlay for the labour he employs is his payroll or wage bill.[6] The annual reports on manufacturing contain figures on total wages paid to production and related workers and total salaries paid to administrative, office and other nonmanufacturing employees. These figures are made up of actual wages and salaries paid (including time paid for but not worked, like holidays and vacations) but exclude payments made by the employer for wage supplements, that is, fringe benefits other than paid time off. (Statistics Canada estimates of unit labour cost include an estimate of the cost to the employer of these fringe benefits which has not been done in our study.)

In addition to data on number of workers employed, or manhours paid for, and employer outlay on payroll for this labour, the other vital piece of information obtained from the Census of Manufactures pertains to value added. This is a measure of the value of net output, in effect, the unduplicated additional value created by the application of labour and capital in the establishment.[7] The gross measure is value of shipments; before 1961 only one figure was published, "selling value of factory shipments", but since then there have been two figures, "value of shipments of goods of own manufacture", and "total value of shipments and other revenue", the latter consisting of the former plus "value of shipments of goods purchased for resale and other operational revenues". (This new breakdown is related to introduction of the concepts of "value added by manufacturing" and "value added by total activity", described just below.) The valuation is based upon whatever unit price is attributed to the output as it leaves the establishment, which may be some kind of wholesale price or, where there are direct sales to the ultimate consumer, a retail price, or, where the output is a semifinished item due for further processing, whatever money value is imputed to each unit of output.

This measure of gross value includes the cost of raw materials and of fuel and energy consumed, which are inputs brought into the establishment from outside. The money spent on these inputs is deducted from the gross value of shipments to produce the figure for value added. (Adjustments for inventory value changes are made, which are described at the end of this chapter.)

Before 1961 a figure was published only on value added by manufacture. Since 1961 separate data are available for value added by manufacturing and value added by total activity. The latter incorporates value added by manufacturing along with other forms of value created by nonmanufacturing activities of the establishment, such as trading in goods not of its own making, construction by its own labour force, revenue from services like repairs, etc. carried out by the establishment's labour force rather than being purchased from outside. It is pointed out that, "This total value added figure may, in some cases, be less than value added by manufacturing activities as a result of expenditures associated with non-manufacturing exceeding

revenues from such activities or because of a decrease in inventory of goods not of own manufacture exceeding the mark-up on the sale of such goods."[8]

Our study is concerned with both value added by manufacturing and value added by total activity for these reasons:

1. It is not possible to separate the labour force associated with manufacturing activities from that associated with nonmanufacturing. While the production labour force is primarily engaged in manufacturing activity, this is not entirely so, and it is even more difficult conceptually to separate the nonproduction labour force in its association with manufacturing and nonmanufacturing activity. Therefore, we have produced measures of productivity and unit cost based on both concepts of value added.

2. The measure of real output (described later in this chapter) incorporates elements of nonmanufacturing as well as manufacturing activity; there are no measures allowing for their separation.

The need to use homogeneous statistical data in measuring changes in productivity and unit costs of production has already been stressed. Thus, data on labour employed should be consistent with the basis on which data on output are reported if a ratio of output to labour employed is to be valid. However, less than ideal data must sometimes be used if no serious violence is done to the principle of homogeneity and where the alternative to a somewhat imperfect measure is no measure at all.

To a degree, this can be said about the calculation of the implicit or value-added price index (value added per unit of output). This is produced by dividing the index of value added by the index of real net output (and, as in the case of any index, multiplying by 100). The latter measure is described and discussed further on in this chapter, but it should be pointed out right here that the 1961 revisions of the indexes of real domestic product (the measure of real net output used herein) incorporated an extension of the total activity concept to manufacturing.[9]

The incorporation of the total activity concept began in 1961, simultaneous with the introduction of the concept of value added, total activity. From 1961 on, it is in line with the principle of statistical homogeneity that the index of real net output (now incorporating the total activity concept) be divided into an index of value added by total activity. The inconsistency arises in dividing an index of value added by manufacturing by the index of real net output; there is only one output index for each industry, which is based on the total activity concept. To the extent that there is a difference between movements of value added by manufacturing and value added by total activity, an index of value added (manufacturing) per unit of output is deficient. Fortunately, the difference between the indexes of value added (manufacturing) per unit of output and value added (total activity) per unit of output is not very great for most industries.[10]

Because the period covered is 1949 to 1968 which cuts right through a number of important revisions to statistical series, it meant revising the data to ensure as much consistency as possible for the entire time period. No adjustment of the data was possible for the introduction of the total activity concept, but this does not seem to constitute a serious problem.[11]

The Census of Manufacturing data were revised, during the period under review, to incorporate changes in the Standard Industrial Classification, changes in the concept of the establishment, and introduction of the total activity concept. These changes affected the data on employment, wage and salary payments, and value added. Data on real output, namely, the indexes of industrial production and, subsequently, of real domestic product, have been revised at different times, both to reflect the changes described above and to incorporate other statistical and conceptual refinements. First, reference to the Census of Manufactures revisions is appropriate, with changes in the measurement of real output being considered subsequently.

As pointed out at the beginning of Chapter Three, the establishment is the basic unit whose productive operations are analyzed. Each establishment must be assigned to a particular industry on the basis of the kind of product it produces or service it provides. The first version of the Standard Industrial Classification was published in 1948 and establishments were classified industrially on that basis up to and including 1959. As time passes, changes in technology, the introduction of new products and the elimination of some old products, and other developments call for revisions to an industry classification code. A revised Standard Industrial Classification was published in late 1960 and put into effect for that year. Data on manufacturing were, in fact, then published on the new as well as the old basis for 1957 to 1959. (A further revision was published in December 1970 but does not affect any of the data used in this study.) The nature of the industry code and its revisions are described in Statistics Canada (formerly Dominion Bureau of Statistics) publications.[12]

Since the period under review, 1949-1968, covers the transition from one industry classification to another, there is the problem of continuity of data for the whole period. There is the question of how to classify data pertaining to an establishment that, on the basis of the old classification, belongs to industry A and, under the revised classification, belongs to industry B. There is the need to adjust aggregate data (that is, from all constituent establishments) for the industry on the basis of the new classification code to establish a linkage with the data based on the old industry code.

It would have been much easier to restrict the time-period to one that does not cover a change in classification codes or other statistical concepts, but, for reasons advanced in the next chapter, the choice of 1949 to 1968 seemed compelling enough to outweigh the associated problems.[13] But choice of this time-period meant excluding some industries that would otherwise have been selected because it proved impossible to establish a reliable linkage between data on the old basis and the new.

An important change in the classification of manufacturing industries was to increase from 17 to 20 the number of what have been called the major groups. Each group consists of subgroups or industries, and the reclassification was, in some cases, largely a redistribution of the industries or subgroups making up a major group. For example, under the 1948 S.I.C. the primary iron and steel industry (code 325) was part of iron and steel products (major group 10), whereas under the 1960 S.I.C., the industry was given a new name, iron and steel mills (code 291), although covering substantially the same operations, and was made part of primary metal industries (major group 12). However, at what is called the three-digit level (the number of digits in the code), there was no problem whatever of continuity between data pertaining to primary iron and steel (1948 code 325) and iron and steel mills (1960 code 291).

The problem was more complex in some cases and required one or both of two solutions. Under the new code, some industry groups or subgroups involved a redistribution of particular industries at the three-digit level. This meant adding into the new data figures pertaining to a three-digit industry that was part of the industry group under the old classification and was removed; and it meant subtracting data based on three-digit industries that are now part of the industry group but formerly were not. This amounts to restoring the old S.I.C. for the purpose at hand, a technique that might be subject to criticism but is essential to our study.

Not only were specific industries or subgroups redistributed by the Dominion Bureau of Statistics (now Statistics Canada) but establishments were often taken out of one industry and put into another. It would have been an enormously difficult task - even if the raw data were available - to have attempted to reclassify all such establishment data to conform with the old S.I.C. or at least to make a linkage possible. A different kind of adjustment was possible arising out of the fact that for the years 1957 to 1959 inclusive data were published on the basis of the old (1948) and new (1960) S.I.C., so that an adjustment factor, expressing the difference between the data on the old and new basis, could be derived. We have applied this factor to data for the subsequent years.[14]

Along with the revised industry classification code, a new definition of establishment was introduced. The establishment is not only the basic productive unit but is also the basic reporting unit in the Census of Manufactures, so that changes in the definition of establishment affected, not surprisingly, the nature of the data reported from the establishment.[15] The combined effect of these two changes, in the S.I.C. and in the definition of establishment, is reflected in the comparative figure for 1957-1959 inclusive, so that the adjustment factor, described above, allows for both changes.

The third and final revision embodied introduction of the concept of value added by total activity, on which data would be published, along with data on value added by manufacturing. These two notions of value added have already been described and compared in this chapter. Data on the old and new basis were published, in the case of this revision, for only one year, 1961,[16] but an adjustment factor, embodying the difference between the old and new data, was developed, to be applied to the figures for 1962 and after, following application of the first adjustment factor, described above.[17]

It is recognized that the redistribution of industries and subgroups and application of the adjustment factors just described do not make for perfect continuity in all the data for 1949 to 1968, inclusive. But data of the kind used for this study unavoidably have imperfections and discontinuities aside from those that might arise from trying to link an old and new series. On balance, it can be argued that our adjustments largely eliminate what would otherwise be a serious imperfection, serious enough in some cases to prohibit use of the data.

The only other revision affecting data used in this project concerns changes in the indexes of real output. However, in this case there was no need to adjust any of the measures obtained from Statistics Canada publications,[18] but rather to introduce the new series at the point where the old series left off. The new index of real domestic product is presented, of course, in terms of the 1960 Standard Industrial Classification while the earlier series was based on the 1948 S.I.C. Because of the absence of any linkage for some industries between the old and new series, certain industries could not be covered by this study and the components of certain industries that are covered had to be altered from what was originally intended.[19]

The one basic data input that remains to be discussed is the measure of real output or, more accurately, real net output. This is a very important measure because it is the denominator in the equation appearing at the beginning of this chapter and the numerator in the measure of labour productivity expressed as change in output per unit of labour input.

This study is concerned not with gross but with net output, which, in current dollar terms, is value added. This notion has already been discussed and it has been pointed out that whereas VA is an index of value added, in current dollars (that is, making no allowance for change in implicit price), Y is an index of real net output, which is tantamount to value added, deflated for change in unit price.

In most cases, the National Output and Productivity Division, Industrial Output Section of Statistics Canada has been able to employ what is called the double deflation technique to produce an index of real net output (for brevity's sake, hereafter to be called real output), but in some situations, because of a lack of data and/or methodological difficulties, some indicator of net output, other than net output itself, had to be employed.

One of the simplest definitions of the double deflation technique appears in a publication of the International Labour Office:

> "...special price indices are constructed for each industry for each component of value added (value of shipments, inventories, etc.). The constant dollar value of each of these components of value added is obtained by deflating the current dollar value of the specified component by its appropriate price index. Value added in constant dollars is then obtained for each industry by deducting the deflated value of material purchases or service costs from the deflated value of output (shipments adjusted for net inventory change.)"[20]

This study is not directly concerned with how measures of real output for each industry are aggregated to produce a measure of the total output of the national economy. However, a passing reference will help to explain and put into perspective the index of real domestic product. Gross domestic product at factor cost is the value of total national output based on aggregate payments made to all factors of production in the form of wages and salaries, interest, dividends, and rent and income of unincorporated business. (Indirect taxes and subsidies are not factor costs; added to gross domestic product at factor cost, they produce gross domestic product at market prices.) GDP at factor cost for the national economy is in fact the sum of gross domestic product originating in each industry, which is equivalent to value added in each industry.[21]

If GDP at factor cost were the sum of a measure of output in each industry that covered more than value added, for example, gross output, allowing for the cost of raw materials, then the national aggregate would incorporate elements of double, triple or even higher degrees of multiple counting. Wherever the output of one industry became the input to another (for example, iron ore from an iron mine shipped to an iron and steel mill), the value of that original input would be counted again. What is required, therefore, is a measure of the *unduplicated* creation of real value by each industry. This is obtained by the double deflation method which provides for the deduction of constant dollar cost of inputs, namely raw materials, fuel and electricity, from the constant dollar value of gross output.

The construction of the index of real output (whether it is called an index of industrial production or of real domestic product) can be briefly described as follows:[22]

For the base year, the value of gross output for each important commodity produced in the industry[23] is divided by total output, measured in physical terms, to produce a base-year unit price for that class of output. (In more recent years there has been increasing use of industry selling price indexes for this purpose, which are expected eventually to replace base-year unit values.) For any reference year (i.e. a year other than the base year) physical output of each commodity for that year is multiplied by its base-year unit value; the resulting values for all commodities are aggregated.[24] This figure is then indexed over the base-year value to produce an index of gross output. It is expressed algebraically as follows:

$$\frac{\Sigma Q_1 P_0}{\Sigma Q_0 P_0}$$

where Q and P stand for the quantities and unit values of the commodities comprising total output of the industry. Because base-year prices are used, it means that the index is base-weighted. Similar computations are made for the quantities and unit price of the inputs obtained from outside the establishment, and by a similar technique, the value of inputs at base-year unit prices is computed, which is then subtracted from the gross value of output in base-year dollars. The resulting net figure, indexed over the base year, produces the index of net output. The formula is:

$$\frac{\Sigma Q_1 P_0 - \Sigma q_1 p_0}{\Sigma Q_0 P_0 - \Sigma q_0 p_0}$$

where q and p stand for quantities and unit values of materials, fuel and electricity used in production, Q and P are as described above.[25]

It will be noted that base weights are used and it will be recalled from Chapter Three that a similar type of weight is used in this study, so that there is consistency throughout. One feature of base-weighted series is the need for periodic revision of the weights, based on actual values in a new base year. Among other changes incorporated in the new indexes of real domestic product (base year 1961) compared with the earlier (base year 1949) series is the application of new weights. It is necessary periodically to introduce new weights to reflect the changing organization of productive activity and composition of total output.

This technique has not changed in its essentials. The revisions have been intended to incorporate new base weights, the new Standard Industrial Classification, improved measures of output (both gross and net), and new concepts such as that of total activity.[26] Of course, the double deflation technique is used wherever possible but for a few industries, as was mentioned previously, it has not been possible, so that some other type of indicator is used to represent changes in net output. Gradually, this expedient is being abandoned but is still necessary in a few cases.[27]

The objective of any essentially statistical study of this kind is that the measures devised record actual changes in the economic activities or units to which the data refer and should not reflect any element of change that is purely statistical. Of course, such an ideal can never be perfectly realized, for many reasons.[28] The quality (accuracy, completeness, consistency, etc.) of the raw data that are collected will vary from one reporting unit to another and from one reporting period to another. Whether an index is base-weighted or current-weighted, each has its shortcomings. Industry and commodity classifications, concepts of an economic unit (the establishment or something else), of economic activity, of units of output, and so on, must be defined rather rigorously if reasonable accuracy is to be assured for statistics designed to measure these things. But this means that these statistics never reflect perfectly the reality (however it is conceived) they are supposed to measure and record. All we can do, in using statistics, is to be as fully informed as possible of the definitions, concepts and mathematical techniques that are used and of how the raw data are gathered; and to relate all of this to what is known on the basis of all reliable knowledge, statistical and nonstatistical, about what the statistics are referring to. In producing such statistics, every effort must be made to ensure that they measure what they are intended to measure, that changes in concept or methodology be made to meet changes in the nature of the economic activity to which the statistics refer. At the same time, care should be taken to prevent changes being made too frequently or on essentially minor matters where they interfere with consistency and make it extremely difficult to conduct an analysis over a period of time.

This chapter concludes with a brief reference to changes in statistical concept and method that have probably had some effect on the measurement of real output which our study has been unable to isolate or measure. Perhaps subsequent research can do so but meanwhile we should at least be aware of them.

These factors are:

1. In 1952 the Census of Manufactures switched from obtaining data on the basis of value of production to value of shipments. In most cases "...the value of production for each industry is obtained in total by adjusting the value of factory shipments for changes in the book value of plant inventory of finished goods and goods in process."[29]

2. The level of net output can be influenced by the degree of vertical integration, that is, whether an establishment is supplied from outside with certain partly finished goods (in which case they are a raw material input) or obtains the raw materials and does that part of the finishing itself (in which case it is creating more value added in that establishment.)[30] The more the processing is done in the establishments, the greater the degree of vertical integration; and if vertical integration increases, value added increases (although at the same time there is a decrease in the establishment that formerly produced the semi-finished goods).

3. Changes in the product mix can be important. "The more diversified the production of an industry, the more sensitive the net output index is to the influence of product mix. This is particularly true of those industries with a high input-output ratio (i.e. those in which materials account for a large proportion of the value of products, such as meat packing, dairy products and flour and feed mills) where even slight changes in the composition of production have a considerable effect on the 'net' measure".[31] In Chapter Two there was a reference to changes in product mix on measures of labour productivity.

4. Accumulation of inventory can have an effect on the measure of value added and of real output. Inventory is unsold production and does not enter into value of shipments as such, but when this figure is used in the computation of value added (by subtracting from it the cost of materials, etc.), it is adjusted for changes in the value of inventories of finished goods and goods in process.[32] While inventory does not affect value added, except as noted, the inputs required for producing that inventory have already been used and their cost must be deducted from gross value before value added can be calculated. By this token, as inventory accumulates, value added is liable to decline, as is real net output attributed to that establishment.

5. The new definition of establishment can produce discontinuities between the old and the new series; however, we have tried to adjust for them, as described earlier in this chapter. While the statistics for the most recent years have come closer to realizing the objective of measuring all economic activity occuring within an establishment, certain earlier practices in the reporting of such activity caused distortion or statistical gaps in production data. "For example, certain establishments were split arbitrarily between two or more activities such as between coke and gas production. Further, establishment production statistics were generally confined to major activity, thus leaving unrecorded the output or value of economic production arising from secondary activities."[33]

It can be seen that factors 2 and 3 reflect actual economic changes; that is, changes in the degree of vertical integration or changes in the product mix are not essentially statistical although they do affect statistics, but reflect changes in the organization of economic activity or the kind of products produced. The fourth item, changes in inventory, can reflect actual economic changes as well as the kind of valuation system used for pricing inventory. The fifth factor is definitely statistical, but the difficulty has been largely overcome in the more recent statistics.

Even if it were statistically feasible, this study would not try to adjust for changes in degree of vertical integration or product mix because our inquiry is into productivity and unit costs of production based on what is produced and how it is produced and not into "pure" productivity or cost change where the relation is between a specific type of output and the inputs required. It is unlikely that the first factor, the shift from measuring gross output in terms of value of shipments rather than value of production, has seriously affected any of the statistics used, and anyway the effect could only be on the data for the years 1949-1951 inclusive.

Footnotes

[1]Alternatively, it could be obtained by indexing the residual, thus, $\frac{(va\text{-}w)_1}{(va\text{-}w)_0} = R$ which is then indexed over Y, R/Y; but this produces a current-weighted index, while the method described in the previous chapter produces one that is base weighted, which is to be preferred.

[2]In fact, the census is of other industries besides manufacturing, and is referred to in the broader context as the Census of Industry, but this study refers to that part concerned with some of the manufacturing industries, which is why it is called the Census of Manufactures.

[3]The most recent information on the Census of Manufactures is found in *Manufacturing Industries of Canada*, Section A, 1965 (Catalogue No. 31-203), notes entitled "Concepts and Definitions" at the back of the report. The survey is described and terms are defined. See also "Explanatory Notes" in the edition of this publication for 1962.

[4]International Labour Office: *Measuring Labour Productivity* Geneva, 1969, page 17.

[5]Admittedly, such a statement is debatable. Now that this study is finished, the author believes that future research should be possible in which nonproduction labour is separately taken into account. However, the reasons for the present decision are offered in detail in Chapter Five.

[6]This study prefers not to describe such an outlay as the employer's labour cost. Payroll is an amount of money paid for the services of a given quantity of labour time and may, for some purposes, be construed as a cost. But in the kind of analysis that constitutes this study, money paid by an employer for labour time must be considered as money paid for the production made possible by that labour time. Thus, labour cost is a ratio between payroll and the value of output produced by the labour time purchased. (Obviously, the production is not made possible purely as a result of labour expended, but that is not germane to the principle enunciated here.)

[7]For a fuller description see Chapter Three.

[8]D.B.S.: *Manufacturing Industries of Canada* Section A (Catalogue No. 31-203), 1965.

[9]D.B.S.: *Indexes of Real Domestic Product by Industry, 1961-1969* (Catalogue No. 61-510).

[10]The indexes of implicit, value-added price are examined and discussed in Chapter Six.

[11]Any effort to relate changes in current dollar value added to changes in constant dollar net output will encounter some difficulties because of certain differences or inconsistencies between the two series. However, the inconsistencies did not seem important enough to warrant the effort necessary to make suitable adjustments to the data. For example, Statistics Canada calculations of net output take into account rental revenues to manufacturing establishments but they are not included in current dollar data on value added. In a few industries, including some covered in our study, part or all of the trend in real output is calculated from gross rather than net output indicators. This suggests that in such cases our estimation of trend in implicit, value-added price is based on relating change in current dollar *net* output (value added) to change in constant dollar *gross* output, where the appropriate value should be change in constant dollar *net* output. While the possibility of inconsistency in our estimates cannot be ruled out in such cases, we have used the data notwithstanding because indexes of real output have been published for these industries. Similarly, for some industries the net output indicator has replaced a gross output indicator used for the earlier years, covered by our study. Once again, we have only chosen industries where it was indicated in D.B.S. report no. 61-506, Appendix I, that a continuous trend could be derived from linking the old and new series. (The industries covered by our study where a gross output indicator has been used throughout, in full or in part, are: clothing industries, motor vehicles, motor vehicle parts and accessories, smelting and refining, electrical products, cement manufacturers; the industries where gross output was used from 1949 to 1960 are: slaughtering and meat processors, tobacco products, agricultural products.)

Our estimates of implicit, value-added price are the first to be published in a report of a federal government research body. All responsibility for them is assumed by the author of this study and any criticisms must be directed to him and not to Statistics Canada whose published data were used. It is hoped that subsequent research by the Canada Department of Labour or by others will incorporate revisions or further adjustments of the data to allow for inconsistencies, thus making possible more refined measures than presented here. In carrying out a study of this kind, many further refinements come to mind as the work is done, but if each one were to have been attempted, completion of the study would have proved impossible.

[12]See D.B.S.: *Standard Industrial Classification Manual* (Catalogue No. 12-501), December 1960, and for the latest changes, a new manual by the same name and catalogue number, dated December 1970.

[13]Some of our analysis begins with 1961, when most of the revisions took effect, but this is because the data used for that analysis were not available for earlier years.

[14]A guide to industry classification links between 1948 and 1960 S.I.C. systems appears as Appendix I to D.B.S.: *Indexes of Real Domestic Product, by Industry (1961 base)* (Catalogue No. 61-506).

[15]The change in the definition of establishment and how it affected the data reported are described in D.B.S.: *General Review of the Manufacturing Industries of Canada, 1961* (Catalogue No. 31-201) under "Explanatory Notes".

[16]Introduction of value added by total activity did not mean just the introduction of some new statistics but revisions to kinds of data that already were being published.

[17]The formula for the two adjustment factors is given in Appendix A, along with a list of the factors derived for each industry.

[18]In fact, adjustments would have been impossible because index numbers cannot be manipulated the same as absolute numbers, like those obtained from the Census of Manufactures; unless, of course, detailed information is available on the components of the index numbers and the computations used. Such information is not available.

[19]For the industries covered in this report, indexes of real domestic product, on a 1961 base year, were presented for the years, 1949 to 1967 in *Indexes of Real Domestic Product by Industry* (Catologue No. 61-506), Table 1; however, in February 1971, revised indexes were published for the years, 1961 to 1969 (Catalogue No. 61-510), necessitating substantial last-minute revisions of measures already prepared for this study. While figures in this new report went up to 1969, absence at the time of comprehensive data from the Census of Manufacturers beyond 1968 meant ending the period covered for this study at that year.

[20]ILO: *Measuring Labour Productivity,* Geneva, 1969, page 30.

[21]How gross *domestic* differs from gross *national* product is described in D.B.S.: *Indexes of Real Domestic Product by Industry of Origin, 1935-1961* (Catalogue No. 61-505), 1963, page 35.

[22]This description is based primarily on the D.B.S. report: *Revised Index of Industrial Production 1935-1957 (1949 = 100)* (Catalogue No. 61-502), 1959. This report has been superseded by more recent publications, some of which are cited in subsequent footnotes, but the basic technique has not changed.

[23]Most indexes of physical or real output do not specifically cover changes in output for all the component commodities produced in an industry. However, "If prices or appropriate unit values are available for the major proportion of the products of an industry, it can be reasonably assumed that prices of the remaining products move approximately in the same way." - ibid., page 20.

[24]For that amount of gross output for which commodity output or price data are not available, an index of unit price is computed from data for the covered commodities (see previous footnote), and applied to the unrepresented products.

[25]Detailed examples of how the computations are actually made appear as sample worksheets in these D.B.S. reports: *Revised Index of Industrial Prduction, 1935-1957* (Catalogue No. 61-502), page 27; and *Productivity Trends in Industry, Report No. 1* (Catalogue No. 14-502), 1966, page 133.

[26]The D.B.S. special reports on real output have followed this succession: *Revised Index of Industrial Production,* 1935-1957 (1949 = 100) (Catalogue No. 61-502), 1959; *Indexes of Real Domestic Product by Industry of Origin,* 1935-61 (Catalogue No. 61-505), 1963; *Indexes of Real Domestic Product by Industry* (1961 Base) (Catalogue No. 61-506), 1968; *Index of Real Domestic Product by Industry,* 1961-1969 (1961 = 100) (Catalogue No. 61-510), 1971. Further useful information and

description of concepts and methodology are found in: *Indexes of Output per Person Employed and per Man-Hour in Canada, Commercial Nonagricultural Industries*, 1947-63 (Catalogue No. 14-501), 1965; *Productivity Trends in Industry, Report No. 1 - Synthetic Textile Mills, Breweries, Pulp & Paper Mills* (Catalogue No. 14-502), 1966; *Productivity Trends in Industry, Report No. 2 - Iron & Steel Mills* (Catalogue No. 14-502), 1970.

[27]The type of indicator used for each industry is shown in Appendices II and III to the D.B.S. report, (Catalogue No. 61-506), already cited.

[28]A very interesting examination of sources of statistical error and inaccuracy is found in Oskar Morgenstern: *On the Accuracy of Economic Observations*, Second Edition, Princeton University Press, 1965.

[29]D.B.S.: Report (Catalogue No. 61-502) cited in footnote 26; page 21.

[30]ibid., page 21.

[31]ibid., page 22.

[32]D.B.S.: *Manufacturing Industries of Canada* (Catalogue No. 31-203), 1965, under "Concepts and Definitions", see "Value Added" (pages not numbered).

[33]D.B.S.: Report (Catalogue No. 61-505), cited in footnote 26; page 64.

CHAPTER FIVE

Industry and Time Period Coverage and Other Choices Made for This Study - An Explanation and a Defence

As with virtually all statistics, productivity measures embody a compromise. Compromise may be necessary because some data are available and others are not; one may have to choose between using imperfect data because no others are available, or making no measurements at all. Compromise is likely where different needs dictate different kinds of measures, and yet one measure must suffice to meet all needs.

One ideal is to produce highly disaggregated measures of productivity and unit labour cost for every precisely defined industry. Obviously, this is not immediately possible because the resources for such an operation are just not available and the necessary statistical data are lacking in many cases. Therefore, industries had to be selected. This study is restricted to manufacturing industries partly because measurement of productivity is comparatively easier for manufacturing than for most other industries. Our selection is described and explained presently. Another necessary choice was the time period to be covered. We chose 1949 to 1968, inclusive, using only annual aggregates or averages (that is, there is no analysis of monthly or quarterly or other data within a year). Many problems could have been avoided with the selection of a shorter period, which has already been pointed out, but the reasons for our decision are explained in this chapter. The chapter concludes with a few words about the choice of labour inputs used as the basis of the productivity measurements.

Choice of Industries

In the list of industries that follows, in most cases the name used is that found in the *Standard Industrial Classification Manual* published in December 1960; a more recent manual has been published (to which reference has been made earlier in this report), but this study is based on the industry classifications and names found in the earlier manual. In a few cases, for the sake of brevity, the word "industries" or "manufacturers" has been eliminated from the titles used here where it does not alter the meaning in any way; otherwise, the titles used are those found in the S.I.C. Manual. The industries are:

Slaughtering and meat processors
Bakery products
Distilleries
Breweries
Tobacco products
Rubber industries
Cotton yarn and cloth mills
Synthetic textile mills
Clothing industries
Furniture and fixtures
Saw and planing mills[1]
Pulp and paper mills
Printing, publishing and allied industries
Iron and steel mills
Agricultural implements
Motor vehicles
Motor vehicle parts and accessories
Smelting and refining
Electrical products
Cement manufacturers
Petroleum and coal products
Chemicals.

In addition, measures have been prepared for total manufacturing, which is not a total for the 22 manufacturing industries just listed but a total for all manufacturing industries, those covered by this study and those not covered.

One explanation for the choice of industries is that suitable data are available for them covering the entire period. Originally, plans were made to include machinery and machine tools, sheet metal products, and jewellery and silverware, but a lack of essential data made it impossible. However, the principal explanation of the selection rests upon the original reason for the inception of this study. Some industries were selected because a large part of their output is exported, other industries, because their product, which is sold primarily in the domestic market, must compete with imports of the same product; some were selected because they are neither export-oriented nor import-competing; while a few industries export a significant proportion of their output and still have to compete with imports of the same products in the domestic market. The classification into which each industry falls can be best judged from Table 1 where the value of exports in each instance is expressed as a percentage of the gross value of production and the value of imports of the same group of commodities is expressed as a percentage of the value of total market sales of that group of products for the year.[2] The estimates are necessarily imperfect because statistics on exports and imports are published only on a commodity and not on an industry basis; the estimates required attributing each commodity to a particular industry. However, they are certainly accurate enough to indicate the relative importance of exports and imports to the production and trade of each industry. The data in Table 1 are for 1965.

These percentages would no doubt be different in other years than 1965, but for most industries they would not be likely to differ substantially from one year to another even though there may be a secular trend upward or downward. However, there can be no doubt that the percentages on both exports and imports for motor vehicles and motor vehicle parts and accessories would be considerably higher for more recent years than they were for 1965, as a result of the impact of the automotive parts trade agreement between Canada and the United States.

These industries illustrate a wide variety of economic and technological characteristics. One is the considerable variation in the importance of labour costs to value added; in 1968, the proportion of payroll to value added, manufacturing ranged from almost fifty percent for bakeries to as low as nine percent for petroleum and coal products and for distilleries.[3]

Choice of Time Period

Not all of the analysis covers the entire period, 1949 to 1968 because certain measures were only feasible from 1961 on; however, approximately two-thirds of the findings relate to the full twenty years. The values are in all cases annual aggregates or averages, there being no measurements for periods of less than one year.

Covering a period as long as this has its disadvantages, and many of them have already been discussed. Changes in statistical classifications, concepts, definitions and methods of measurement create problems of statistical continuity, although we have taken steps to maintain as much continuity as possible. Economic conditions change with the passage of time, and some of the changes are sufficiently fundamental and far-reaching to affect the validity of statistical measures of economic activity. However, we have tried neither to measure nor to allow for this.

Notwithstanding these difficulties and, indeed, partly because of them, we believe that a study of this kind should cover as long a time period as possible. The very fact that economic conditions do change over the years calls for analysis. Basic long-run changes cannot be distinguished from short-term or cyclical fluctuations unless the period covered is long enough to make such a distinction possible.

From the analytical chapters to follow certain long-run trends in labour productivity and unit costs of production can be discerned as well as some cyclical fluctuations. For example, in some industries a definite downward trend in unit labour costs for seven or eight years may be followed by an equally definite upward trend of a similar duration; if the analysis were confined to a period of ten years or less, the findings would only indicate that unit labour costs were either moving definitely up or definitely down, depending on the stage of the cyclical movement during the time period selected. In other words, the longer-term cycle would not be observed.

The years covered span almost all of the postwar period except for the first years immediately following World War II. They cover the Korean War, beginning in 1950, with all of its economic manifestations, the 1953 and 1957 recessions, and the prolonged period of economic expansion beginning in late 1961. Finally, in the words of Professor William J. Carroll,[4] "The rationale for covering such an extensive period in considering the underlying characteristics of what is generally regarded as a short-run problem is that short-period adjustments and counter-adjustments tend to cancel so that only longer run forces remain. Thus, last year's price increases may have partly stimulated this year's wage demands, and these, by the same token, may induce next year's price increases if not obviated by upward movements in productivity. Such adjustments tend to proceed in spurts rather than evenly, and vision may become blurred if the time perspective is too small."

In short, if the purpose of a study of trends in productivity and unit costs is to identify basic trends and how they might be affected by changing economic conditions, it is necessary to cover a period long enough to embrace conditions of economic expansion and contraction, of inflation and relative price stability, of high and low unemployment, and so on. The choice of 1949 to 1968 meets this requirement rather well.

Table 1

Relative Importance of Exports and Imports
to Each Industry, Estimate for 1965

Industry	Exports as a Percent of Value of Production	Value of Imports as a Percentage of Value of Total Market Sales
Slaughtering and meat processors	8.9*	4.9
Bakery products	0.6	0.9
Distilleries	54.5	18.8
Breweries	1.5	0.8
Tobacco products	9.2	3.0
Rubber industries	2.1	15.4
Cotton yarn and cloth mills	1.3	25.3
Synthetic textile mills	26.3	27.8
Clothing industries	0.9	5.3
Furniture and fixtures	1.6	5.3
Saw and planing mills	50.1	10.1
Pulp and paper mills	67.9	8.7
Printing, publishing & allied industries	1.7	23.5
Iron and steel mills	10.4	20.2
Agricultural implements	59.8	75.1
Motor vehicles	8.4	13.1
Motor vehicle parts and accessories	20.0	31.2
Smelting and refining	56.0	14.3
Electrical products	6.6	18.3
Cement manufacturers	3.8	1.5
Petroleum and coal products	1.6	10.0
Chemicals	34.6	31.0
All manufacturing	N.A.	N.A.

*These percentages would no doubt be different in other years than 1965, but for most industries they would not be likely to differ very much.

Choice of Labour Input Data

Measures of unit residual cost have been produced in three ways. One is by using production workers as the labour input (production workers being typically hourly-rated or piece-work employees), weighting the input by the ratio of wages paid for production labour to value added, manufacturing; the second is by using the total labour force (production and nonproduction labour combined), weighting the input by the ratio of total wages and salaries paid to value added, manufacturing; and finally, using total labour, weighted by the ratio of total wages and salaries to value added by total activity (this last measure being available only for 1961 to 1968 inclusive). Measures of labour productivity and unit labour cost are produced for production labour and total labour, but no such measures have been produced for nonproduction labour alone. In other words, the productivity of salaried employees has not been measured separately. It could have been done by using the employment figures for nonproduction labour and the data on total salaries paid (exclusive of wages) but it was not done for these reasons:

1. It would have prolonged completion of this study.

2. It is true that production labour is not exclusively associated with the creation of value added by manufacturing and nonproduction labour with the residual element which, when added to value added by manufacturing, produces value added by total activity. Nevertheless, it is easier and methodologically more valid to associate the activities of most production workers with the creation of value added by manufacturing than it is to associate the activities of nonproduction labour with nonmanufacturing activities; salaried employees perform many tasks that are essentially related to creating value added by manufacturing. Furthermore, it will be recalled that the index of real domestic product embodies the total activity concept, and there are no separate measures of real output related exclusively to value added by manufacturing and value added by nonmanufacturing.

3. No doubt it is best to measure productivity in terms of total labour input and total output, that is, by relating the entire labour force to value added by total activity; but productivity measurements have traditionally covered the productive effort of the so-called production labour force only, and there is good reason for continuing this practice, even though some doubts are expressed just below. On the other hand, to measure the productivity of a salaried labour force that is so varied as to include everyone from senior executives through the managerial, supervisory, technical, scientific, sales and promotion, and clerical ranks creates conceptual and measurement problems this study is not prepared to cope with.

Finally, the use of numbers of workers rather than manhours as the principal measure of labour input calls for some comment. The measures of labour productivity are all on a per-worker basis, although some estimates based on manhours have been prepared for certain years, for comparison with the main series. The measurement of labour input by manhours is widely regarded as more reliable than by numbers of workers. A manhour is a more homogeneous unit than a worker since labour effort is the input to be measured and not the worker himself.

As the length of the work-week is reduced, the number of hours of labour time expended by any one worker diminishes. If productivity per manhour does not change at all, and the work-week is cut in half (to use an extreme example), it requires twice the number of workers to turn out the same production. On a per-worker basis productivity appears to have declined by 50%, but on a manhours basis there is no change. In fact, productivity ordinarily increases by a modest percentage per year so that nothing quite so startling as suggested by the example would occur. Furthermore, while it can be argued that a manhour is a better, more "pure" measure of labour input than number of workers, manhours themselves are not homogeneous. Partly, this is because the effort expended by a more skilled worker is presumably more productive than the effort of an unskilled worker, and it is also because the effort expended by different workers of the same skill level can be expected to vary considerably. And it must be agreed that, up to a point, the effort and efficiency contributed by a worker will likely increase or improve as weekly hours of work are reduced although there must be a point of no return in such a process. It means that hours worked are certainly not a perfect measure of labour input any more than the number of workers.

Finally, it makes no difference to the calculation of unit labour cost whatever measure of labour productivity is employed. It will be recalled that the formula for change in unit labour cost is W/Y where W is the index of the total wage (or wages and salaries) bill and Y is the index of real output. The value for W is not influenced by whether labour productivity, Y/L, uses, for L, change in number of workers or in manhours.

Aside from these conceptual considerations, the fact is that manhours data were not available before 1961 on a basis that could be used in this study. (The previous chapter discusses the kind of labour input data available to which the reader is referred for further information.) It also happens that the manhours information available from 1961 to the present is only for production labour, data on manhours traditionally not being provided for nonproduction (i.e. salaried) employees. (However, Statistics Canada, in its reports on productivity in industry - cited elsewhere in our study - has made its own estimates of manhours paid for in the case of salaried, nonproduction workers as well as production workers.) This means that if one wishes to compare measures of labour productivity and unit cost of production for production labour and total labour (measures for nonproduction labour alone not having been prepared, for reasons explained above), the data on labour input must be on a per-worker basis.

Two reasons can be advanced for the lack of statistics on manhours for nonproduction labour. One is the difficulty of producing such statistics for people who are not paid by the hour, although it is possible to make estimates, given information on the standard work-week. The other reason is that the contribution of many salaried employees, such as executives, professionals and technicians, may bear little relation to the number of hours they work. Where the contribution of workers, be they senior executives or highly skilled operatives on a machine, is primarily through exercising judgment and making decisions, the concept of homogeneous units of labour time is fuzzy, if not meaningless. Moreover, with the increase in guaranteed income and employment security plans and the extension of paid time off, the number of hours paid for but not worked is growing steadily so that the distinction between wage earners, whose pay is supposed to be based on hours worked, and salaried workers, whose pay is not by the hour, becomes increasingly blurred.[5]

It has sometimes been suggested that the categories of "production" and "nonproduction" labour be eliminated because all workers in the establishment or the firm make a contribution to production. While the contribution of the people traditionally employed in salaried categories may be less direct, this is not always so; with technological advance and the application of computer systems to the production process, increasingly the functions performed by so-called production labour will resemble the functions performed by large nubmers of so-called nonproduction labour.

This chapter opened with the assertion that statistics on productivity embody a compromise. Indeed, the very concept of labour productivity, whether measured by manhours or number of workers, is a compromise, each measure having its merits and shortcomings. Since manhours data are available from 1961 on, any future studies of this kind produced in the Canada Department of Labour are likely to be based in part on manhours, but certainly measurement in terms of numbers of workers will not be abandoned.

Footnotes

[1]This title is not found as such in the manual because certain three-digit industries found in major group 8 (wood industries) were combined for purposes of this study while others in the group were excluded, which meant giving a name to this industry group which is not found as such in the S.I.C. Manual.

[2]We are indebted to Professor William J. Carroll for these computations which were made as part of a study carried out by him for the Canada Department of Labour as part of this research project. The estimates of value of exports and value of imports were derived by Professor Carroll by converting data presented by commodity classification to an industrial basis.

[3]Complete data on these proportions are shown in Table 34.

[4]Quoted from "A Study of Changes in Unit Costs and Prices in Manufacturing Industries", prepared by Professor Carroll for the Canada Department of Labour.

[5]A further consideration of no small significance is that published data are available on total man-hours paid for (worked and not worked) but not just on man-hours worked.

CHAPTER SIX

Production, Prices, Employment and Wages

We now begin our analysis of the statistics compiled for this study. Before labour productivity, unit labour and unit residual costs are discussed, it is logical first to examine trends in production (both real output and value added), employment and wages, from which the productivity and unit cost indexes are derived. Prices (both implicit, value-added price and industry selling price) must then be examined because it will be recalled that calculation of the index of unit residual cost depends in part on the index of implicit price (value added per unit of real output). Aside from that, analysis of price movements is an essential part of this study which has as its basic theme the performance of price and its cost components.

Production and value added[1]

Indexes of production (i.e. the Statistics Canada indexes of real domestic product), of value added by manufacturing and value added by total activity are in Table 2. The production index is the numerator in calculating change in output per worker (Y/L) and the denominator in calculating changes in unit labour cost (W/Y). The index of value added is the numerator in value added per unit of output (VA/Y) which is called the implicit (value-added) price index.

As might be expected, increases between 1949 and 1968 in production varied greatly among the industries. The 1968 production index, averaged for the 22 industries, was 277.4 (standard deviation, 105.3, coefficient of variation, 38.0 percent), with the largest increase recorded for motor vehicles (509.3), and the smallest for agricultural implements (115.9). Expressed in percentages rather than as index numbers, production increased an average of 177.4 percent for the 22 industries, which is very close to the average of 170.6 percent for all manufacturing, comprising the industries covered as well as those not covered by this study. Motor vehicle production increased 409.3 percent and agricultural implements, only 15.9 percent.

Between 1961 and 1968 (1961 being chosen because it marked the beginning of a prolonged general economic expansion and also some new statistical series), output increased by an average of 62.4 percent for the 22 industries (average index, 162.4, standard deviation, 54.5, and coefficient of variation, 33.6 percent), with motor vehicles again exhibiting the greatest increase, 245.5 percent, and cotton yarn and cloth mills, the smallest, at 6.6 percent.

It is noteworthy that the degree of interindustry variation in growth of production, as illustrated by the coefficient of variation, was not too different for 1949-1968 and 1961-1968, 38.0 percent compared with 33.6 percent.

The greatest increase over 1949 was not in all cases in 1968 because in some industries the level of output for that year was less than for one or more previous years. The industries for which 1968 was not the highest production year and the years in which production was greater, are as follows:

tobacco products – 1965, 1966, 1967
rubber industries – 1967
cotton yarn & cloth mills – 1962 to 1967 inclusive
saw & planing mills – 1965, 1967
agricultural implements – 1965 to 1967, inclusive
cement manufacturers – 1964 to 1966, inclusive.

The small increase in output for the agricultural implements industry of 15.9 percent for 1968 compared with 1949, has already been noted; however, the increase is greater if 1966 is used as the basis of comparison when output was 34.3 percent greater than in 1949. Furthermore, production for that industry in 1968 was 92.2 percent greater than in 1961, which was notably in excess of the average increase of 62.4 percent for the 22 industries, but this is no doubt because of the low level of production in that industry in 1961. It will also be observed from Table 2 that the indexes for cement manufacturers are significantly higher for 1965 and 1966 than for 1968.

Attention is drawn to the industries where higher values are found for at least one year before 1968 because further in this study, comparisons of labour productivity and unit costs are made between 1949 and 1968 and 1961 and 1968, but it is not to be assumed that 1968 always represents the highest point an industry attained during this period.

Table 2

Indexes of Production and Value Added

	Slaughtering & meat processors			Bakery products			Distilleries		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	99.6	99.6	–	103.0	105.7	–	107.4	120.1	–
1951	97.0	111.5	–	109.2	122.0	–	129.5	144.9	–
1952	117.1	146.9	–	114.9	135.3	–	131.2	150.5	–
1953	110.8	140.6	–	121.9	143.8	–	151.5	163.7	–
1954	121.8	145.9	–	122.5	140.4	–	146.4	174.1	–
1955	132.7	165.2	–	124.5	145.9	–	154.1	183.9	–
1956	137.4	158.6	–	130.8	150.7	–	178.5	200.1	–
1957	135.9	168.0	–	130.2	161.5	–	174.8	210.4	–
1958	147.1	181.5	–	133.9	171.2	–	185.6	223.3	–
1959	162.7	206.0	–	139.3	178.6	–	198.6	239.6	–
1960	154.4	196.5	–	140.6	184.5	–	196.4	247.9	–
1961	162.0	186.8	100.0	146.2	195.6	100.0	196.8	243.7	100.0
1962	171.5	198.8	106.4	154.5	202.3	103.7	209.2	252.2	103.4
1963	182.4	201.3	107.7	150.6	205.2	105.4	231.8	281.0	115.3
1964	201.0	221.9	119.6	154.4	220.0	113.1	249.1	315.0	129.2
1965	219.2	235.3	127.6	161.1	235.2	121.2	268.8	342.1	140.4
1966	203.8	257.8	138.4	158.6	247.9	127.5	319.0	405.7	166.4
1967	236.3	322.8	173.1	167.7	260.7	133.7	344.9	433.0	177.6
1968	240.1	313.1	166.8	174.3	271.4	140.5	366.4	474.6	195.7

Note: The index of production is the index of real domestic product; the indexes, used on 1961, for that year and since (Cat. No. 61-510) were "spliced" into the indexes for the earlier years that were on a 1949 base (Cat. No. 61-506) and all put on a 1949 base. The indexes of value added are derived from current dollar values and, for value added, manufacturing indexed on 1949, while for value added, total activity, indexed on 1961, the first year for which this figure was introduced. The magnitudes for value added for 1961 and later have been adjusted for purposes of this study, as described in Chapter Four, to meet changes in statistical definitions and measurements.

Sources D.B.S.: *Indexes of Real Domestic Product, by Industry (1961 base)* (Cat. No. 61-506)
Indexes of Real Domestic Product, by Industry 1961-1969/1961 = 100 (Cat. No. 61-510)
Manufacturing Industries of Canada, Section A (Cat. No. 31-203)

Table 2

	Breweries			Tobacco products			Rubber industries		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	99.3	102.8	–	102.5	111.3	–	117.3	131.8	–
1951	100.4	110.3	–	95.9	100.8	–	124.5	158.4	–
1952	116.5	123.8	–	111.0	120.9	–	116.8	159.7	–
1953	123.4	143.7	–	120.5	128.1	–	134.4	169.7	–
1954	122.2	144.7	–	126.9	135.7	–	117.4	146.5	–
1955	129.4	155.0	–	140.5	151.4	–	139.0	183.8	–
1956	134.3	157.6	–	152.4	150.8	–	158.2	195.2	–
1957	143.1	166.4	–	166.0	150.8	–	150.1	173.4	–
1958	139.5	168.7	–	180.4	169.0	–	151.3	171.8	–
1959	149.9	179.7	–	190.8	190.8	–	175.2	185.0	–
1960	153.5	186.0	–	203.8	201.6	–	151.1	166.2	–
1961	157.4	194.4	100.0	212.3	223.8	100.0	147.9	164.0	100.0
1962	164.2	197.4	102.9	215.3	221.7	98.7	193.1	174.3	107.7
1963	171.9	208.6	108.4	227.4	235.8	105.5	199.4	188.0	117.4
1964	175.3	219.8	114.4	242.9	239.3	108.3	214.7	210.9	130.1
1965	177.2	221.0	115.2	253.5	279.0	124.6	226.6	239.0	147.6
1966	192.8	238.7	123.8	264.7	299.2	133.2	251.7	275.0	170.8
1967	198.6	249.7	130.5	261.9	321.3	143.2	270.2	296.5	183.1
1968	200.8	267.4	138.8	245.6	299.1	132.9	263.1	292.9	181.4

Table 2

	Cotton yarn & cloth mills			Synthetic textile mills			Clothing industries		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	117.1	114.7	–	115.4	116.1	–	101.5	100.3	–
1951	111.8	116.9	–	133.9	127.6	–	99.7	104.0	–
1952	87.1	95.0	–	126.7	119.0	–	112.8	117.5	–
1953	89.7	88.2	–	132.2	103.9	–	113.8	120.7	–
1954	91.4	85.1	–	116.3	92.5	–	108.8	111.4	–
1955	93.2	93.0	–	145.9	113.8	–	114.1	117.2	–
1956	94.9	105.1	–	149.2	105.3	–	121.1	122.1	–
1957	96.7	104.5	–	152.2	112.8	–	121.6	127.7	–
1958	98.4	95.7	–	155.9	115.1	–	122.0	128.6	–
1959	100.2	100.8	–	186.9	142.1	–	122.5	133.0	–
1960	100.1	104.4	–	198.6	152.7	–	124.1	135.6	–
1961	111.3	115.3	100.0	217.8	166.9	100.0	129.7	140.5	100.0
1962	120.5	125.5	108 5	249.4	193.1	115.7	134.9	149.3	106.1
1963	128.4	136.1	117.4	278.1	226.4	135.0	142.3	158.7	113.1
1964	142.8	145.6	126.7	316.9	258.9	153.0	148.4	172.3	122.5
1965	145.3	147.7	128.9	314.9	236.4	141.0	155.8	183.8	130.8
1966	127.2	137.6	120.8	328.4	241.8	144.0	157.8	201.7	143.6
1967	126.3	143.4	124.7	360.6	253.5	152.7	154.7	207.0	148.1
1968	118.7	130.3	112.1	405.8	280.2	169.0	162.1	222.7	158.7

Table 2

	Furniture & fixtures			Saw & planing mills			Pulp & paper mills		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	107.2	106.4	–	110.6	124.1	–	108.0	120.7	–
1951	109.0	115.4	–	116.8	139.4	–	117.9	160.4	–
1952	113.7	124.9	–	116.6	136.6	–	112.9	137.9	–
1953	126.4	135.7	–	124.8	142.2	–	117.5	141.7	–
1954	128.4	143.3	–	123.1	140.2	–	122.1	151.4	–
1955	140.8	155.4	–	136.2	157.7	–	126.3	162.9	–
1956	153.6	173.8	–	135.0	152.1	–	136.1	173.9	–
1957	152.3	179.1	–	123.5	131.6	–	131.7	163.7	–
1958	150.4	183.6	–	125.8	136.0	–	129.1	166.0	–
1959	162.6	196.2	–	133.5	142.6	–	140.1	179.7	–
1960	161.0	193.2	–	138.4	139.1	–	148.5	191.6	–
1961	171.5	204.9	100.0	142.2	142.0	100.0	148.5	198.1	100.0
1962	183.6	221.2	107.5	163.8	166.9	116.9	145.2	207.4	104.5
1963	196.7	238.4	116.2	181.6	187.1	130.4	150.8	215.5	108.7
1964	211.9	264.7	129.2	201.5	202.6	140.3	163.5	236.3	119.2
1965	241.2	297.6	145.2	209.6	209.2	145.0	167.5	243.6	122.9
1966	272.0	349.6	170.3	205.9	219.8	153.0	178.3	259.3	130.6
1967	278.0	372.8	181.4	208.9	231.2	161.4	168.7	247.9	124.9
1968	286.1	386.1	187.8	206.5	300.2	203.8	178.9	254.8	128.5

Table 2

	Printing, publishing & allied industries			Iron & steel mills			Agricultural implements		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	109.7	108.5	–	106.6	113.5	–	82.3	86.3	–
1951	112.9	116.0	–	126.7	153.8	–	85.6	91.8	–
1952	114.7	130.2	–	127.2	171.5	–	94.4	118.4	–
1953	125.8	147.2	–	126.9	159.3	–	70.7	99.8	–
1954	135.5	153.8	–	109.1	159.7	–	49.5	62.1	–
1955	142.3	166.4	–	155.7	214.3	–	49.3	68.7	–
1956	157.4	184.2	–	190.0	258.9	–	44.6	64.9	–
1957	159.9	188.1	–	166.4	253.0	–	46.7	73.4	–
1958	157.2	200.9	–	138.5	223.9	–	58.2	76.4	–
1959	169.5	213.5	–	189.2	289.2	–	71.3	98.5	–
1960	173.3	220.6	–	175.8	264.1	–	59.0	80.4	–
1961	177.9	226.8	100.0	194.9	295.5	100.0	60.3	78.3	100.0
1962	181.1	238.8	103.3	212.2	331.3	111.4	63.5	82.9	111.8
1963	184.1	241.2	104.5	236.4	371.3	124.8	92.1	111.8	161.9
1964	188.0	253.9	110.1	269.1	417.3	140.3	114.8	146.0	197.7
1965	201.4	279.9	121.4	297.8	480.4	161.3	126.3	162.3	219.1
1966	213.8	299.5	129.6	293.9	482.1	161.5	134.3	180.1	244.1
1967	220.6	316.5	137.4	268.9	458.9	153.5	132.5	176.0	239.3
1968	225.4	334.9	145.0	314.6	509.2	170.9	115.9	154.2	211.0

Table 2

	Motor vehicles			Motor vehicle parts & accessories			Smelting & refining		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0		–
1950	129.0	156.4	–	130.9	125.0	–	105.4		–
1951	143.5	148.9	–	135.1	144.1	–	113.9		–
1952	150.5	146.7	–	136.1	156.6	–	114.4		–
1953	166.5	150.2	–	146.2	173.9	–	126.0		–
1954	128.3	96.9	–	114.3	138.2	–	127.3		–
1955	168.7	148.0	–	135.5	161.0	–	140.1		–
1956	181.1	163.8	–	145.4	190.2	–	145.7		–
1957	164.8	155.3	–	139.9	177.6	–	142.8		–
1958	138.9	139.4	–	127.2	164.3	–	137.2		–
1959	147.7	194.3	–	148.8	186.5	–	147.2		–
1960	147.1	187.0	–	147.6	185.3	–	173.8		–
1961	147.4	153.9	100.0	138.8	224.8	100.0	170.0	100.0	100.0
1962	166.8	208.0	126.6	171.3	278.7	124.3	181.2	104.2	105.0
1963	216.2	268.7	161.6	203.9	353.2	156.0	182.1	99.2	100.7
1964	233.3	276.3	167.2	223.8	399.2	175.6	199.4	117.2	119.6
1965	316.5	353.9	222.6	267.6	462.9	204.9	207.7	136.1	140.2
1966	332.5	350.4	221.7	294.4	534.7	236.3	223.2	139.0	142.2
1967	442.0	431.5	288.1	292.3	570.2	252.1	228.8	149.8	151.9
1968	509.3	437.2	323.3	355.3	726.3	320.5	246.2	159.7	161.7

Table 2

	Electrical products			Cement manufacturers			Petroleum & coal products		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–	100.0	100.0	–
1950	112.6	117.0	–	104.1	109.5	–	112.0	122.6	–
1951	120.8	131.2	–	106.5	126.3	–	128.4	152.6	–
1952	124.6	147.0	–	114.5	154.9	–	140.2	191.6	–
1953	150.9	169.8	–	139.3	191.8	–	153.6	179.5	–
1954	151.7	171.8	–	140.6	189.5	–	165.0	304.1	–
1955	174.9	174.4	–	156.3	210.3	–	190.2	354.2	–
1956	197.6	214.3	–	181.5	237.5	–	222.6	415.2	–
1957	183.5	211.1	–	221.3	290.3	–	227.6	453.3	–
1958	179.5	194.4	–	224.1	313.9	–	229.8	437.5	–
1959	190.7	210.2	–	223.0	320.7	–	251.9	463.8	–
1960	197.8	210.4	–	208.6	324.1	–	262.8	568.9	–
1961	210.5	217.4	100.0	217.3	362.9	100.0	279.3	586.1	100.0
1962	251.3	258.3	119.5	236.8	397.1	109.3	303.6	573.3	98.3
1963	274.7	275.4	126.8	240.1	417.0	114.1	327.3	576.2	99.2
1964	308.2	306.7	141.3	259.9	453.0	123.5	331.0	580.2	100.2
1965	342.9	337.8	156.9	280.5	494.3	135.1	347.4	536.9	93.2
1966	390.0	386.7	180.0	290.7	527.3	144.1	360.6	559.5	98.2
1967	395.5	388.4	180.4	247.5	477.2	130.3	364.5	592.5	102.6
1968	409.6	411.3	190.9	249.7	508.5	138.3	379.6	666.6	116.0

Table 2

	Chemicals			All manufacturing		
	Production	VA mfg.	VA total	Production	VA mfg.	VA total
1949	100.0	100.0	–	100.0	100.0	–
1950	108.9	110.0	–	106.5	111.4	
1951	123.7	133.2	–	115.7	130.2	–
1952	132.9	143.6	–	120.1	139.6	–
1953	148.5	155.5	–	128.7	149.9	–
1954	161.6	165.2	–	125.8	148.2	–
1955	175.1	183.5	–	138.1	164.2	–
1956	192.3	193.0	–	151.0	180.1	–
1957	208.4	210.0	–	150.7	184.2	–
1958	221.9	230.7	–	147.8	183.7	–
1959	228.6	243.4	–	158.8	193.9	–
1960	240.1	264.6	–	161.5	199.6	–
1961	255.7	276.2	100.0	168.0	210.5	100.0
1962	278.9	297.7	108.0	183.1	236.2	109.6
1963	295.6	314.9	115.2	195.2	241.8	117.7
1964	340.1	343.1	126.2	214.0	266.7	130.3
1965	370.5	373.9	137.0	233.2	294.2	144.4
1966	402.7	408.0	149.8	249.8	322.2	157.8
1967	419.1	426.6	155.6	255.8	335.1	165.1
1968	447.9	459.3	167.1	270.6	359.9	178.1

Industries with an increase in output between 1949 and 1968 exceeding the average of 177.4 percent are designated below as H; similarly, if they exceeded the 1961-1968 average of 62.4 percent, and they are designated by L if they fell below the average:

	1949–1968	1961–1968
slaughtering and meat processors	L	L
bakery products	L	L
distilleries	H	H
breweries	L	L
tobacco products	L	L
rubber industries	L	H
cotton yarn and cloth mills	L	L
synthetic textile mills	H	H
clothing industries	L	L
furniture and fixtures	H	H
saw and planing mills	L	L
pulp and paper mills	L	L
printing, publishing and allied industries	L	L
iron and steel mills	H	L
agricultural implements	L	H
motor vehicles	H	H
motor vehicle parts and accessories	H	H
smelting and refining	L	L
electrical products	H	H
cement manufacturers	L	L
petroleum and coal products	H	L
chemicals	H	H

To anticipate some of the data on labour productivity, a moderately significant association was found between growth in production and increase in output per production worker. For the 1949-1968 period the coefficient of correlation (R) of the former on the latter was .650; R^2 was .423, meaning 42.3 percent of the increase in output per production worker can be associated with the increase in production. For 1961-1968, R was .698 and R^2 .487. This report does not try to explain the "causes" of changes in labour productivity, because it would require an examination of considerable data not used here and calls for some data that are not easily available; it would indeed constitute a separate research project.[2] However, it is easy to compare trends in production and productivity since they are part of the study.

Labour productivity is likely to increase when output is growing rapidly because economies of scale associated with larger volumes of output can be achieved. Conversely, when new equipment is introduced or new methods are applied, causing productivity to increase, it facilitates the rapid expansion of production.

The data on value added do not seem to call for special comment except for a reference to smelting and refining. A very large drop in the index for value added, manufacturing, occurs between 1960 and 1961, from 250.4 to 134.2. This results from a new method of valuation for the industry,[3] producing substantial downward revisions of some data. It can be seen that a similarly drastic drop does not occur for the index of production. Because indexes of labour productivity and unit labour cost are not influenced by trends in value added, there is no problem of a break in the continuity of these series. However, the discontinuity in the value-added series does affect the computation of implicit (value-added) price and unit residual cost; therefore, they have been produced only for 1961 to 1968 for this industry. Because of these exclusions, smelting and refining is not included in any of the averages for industries studied, covering the 1949-1968 period even in the case of measures of labour productivity and unit labour cost. It would be too confusing to include the industry in some of the averages and not in others. Since the revisions took effect in 1961, measures beginning in that year need not be treated with the same reserve; therefore, data are presented for smelting and refining for 1961-1968 on all measures and the industry is averaged in with the other 21 that have been studied when comparisons are made.

Employment

Labour input can be measured by numbers of workers employed or, with respect to production workers, by manhours paid for (data on manhours worked not being available). This study relies almost entirely on numbers of workers, rather than manhours, for reasons explained in the previous chapter.

Changes in production-worker and total employment are set forth as index numbers in Table 3 and there is some analysis in Table 4.

Table 3

Indexes of Production Worker and Total Employment

	Slaughtering & meat processors		Bakery products		Distilleries	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	99.2	99.7	97.8	97.4	103.1	102.2
1951	101.0	101.6	100.4	99.9	118.1	115.1
1952	112.6	111.1	102.6	101.9	122.2	118.6
1953	112.3	111.1	106.0	104.8	132.3	126.7
1954	110.9	111.7	105.1	104.3	129.2	125.2
1955	115.0	114.9	106.3	105.4	133.6	128.4
1956	119.7	119.8	109.3	108.2	142.1	134.8
1957	121.1	121.9	108.9	108.3	134.7	130.2
1958	124.4	124.9	109.1	107.9	127.1	124.9
1959	132.7	130.5	110.9	109.9	120.2	121.1
1960	127.8	126.9	113.0	112.2	110.2	113.6
1961	125.0	124.2	111.9	110.1	98.9	108.8
1962	119.4	119.5	109.1	109.6	94.4	107.4
1963	119.7	118.3	108.5	108.2	88.8	104.1
1964	122.3	121.7	109.2	109.2	90.6	105.6
1965	124.5	124 5	111.6	111.9	96.2	112.3
1966	124.2	124.2	117.1	115.0	105.2	122.4
1967	144 2	139.8	118.2	115.4	106.2	126.6
1968	141.2	137.4	114.5	111.2	105.4	131.0

Source D.B.S.: *Manufacturing Industries of Canada,* Section A (Catalogue No. 31-203) (Indexes computed from data in the report on numbers of workers employed)

Table 3

	Breweries		Tobacco products		Rubber industries	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	95.9	96.1	95.5	96.6	105.9	105.2
1951	94.3	97.7	90.4	92.0	110.1	111.2
1952	92.8	94.3	85.2	86.8	100.8	104.1
1953	94.6	96.9	88.9	88.8	105.6	109.0
1954	96.7	98.7	89.3	88.6	98.3	100.8
1955	93.0	96.7	90.0	89.2	103.9	105.7
1956	95.3	100.8	90.8	90.0	109.2	111.6
1957	92.3	97.2	93.0	92.7	103.9	107.0
1958	89.0	94.2	96.3	96.6	91.4	96.2
1959	86.5	92.8	95.2	96.3	97.6	101.8
1960	83.0	90.9	88.3	91.1	93.8	97.9
1961	80.1	88.1	85.3	88.4	88.4	100.5
1962	74.2	83.5	91.3	94.7	96.9	94.3
1963	74.0	84.2	93.3	93.6	104.4	100.9
1964	72.4	85.4	89.3	92.4	108.7	106.3
1965	73.1	87.4	85.6	87.2	112.5	110.8
1966	72.7	86.7	84.9	86.5	121.1	117.3
1967	73.1	86.0	85.5	89.7	113.7	112.8
1968	72.3	86.8	81.5	86.6	101.2	102.8

Table 3

	Cotton yarn & cloth mills		Synthetic textile mills		Clothing industries	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	107.0	107.1	103.1	106.7	99.1	99.7
1951	110.0	109.7	103.8	106.9	98.8	99.2
1952	88.4	91.2	87.0	93.4	104.0	103.4
1953	89.0	92.1	87.7	93.4	105.6	104.8
1954	75.4	78.9	71.8	81.2	101.4	98.2
1955	79.4	85.5	81.5	91.6	99.2	98.2
1956	80.9	87.1	92.6	93.3	99.5	98.3
1957	77.5	83.9	79.2	90.6	101.7	99.8
1958	69.5	77.2	75.5	85.8	97.1	96.1
1959	65.2	72.3	77.8	89.2	96.8	96.0
1960	60.8	66.9	80.1	90.3	97.3	96.3
1961	63.4	69.1	86.5	95.9	99.8	97.8
1962	65.3	71.4	93.0	102.4	99.8	96.1
1963	64.1	70.1	98.9	108.4	102.4	96.7
1964	66.4	72.1	109.5	118.9	107.9	101.0
1965	66.6	72.0	112.8	123.3	110.1	103.4
1966	58.9	65.2	113.7	126.3	112.1	104.4
1967	62.2	68.2	117.2	128.4	111.1	102.9
1968	52.0	58.1	111.1	123.9	111.1	102.3

Table 3

	Furniture & fixtures		Saw & planing mills		Pulp & paper mills	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	101.1	101.5	106.9	106.3	99.9	100.6
1951	99.6	101.5	112.4	111.6	109.2	110.0
1952	98.8	101.5	108.4	109.5	110.2	111.0
1953	108.5	110.9	108.9	110.5	111.3	111.8
1954	108.0	110.8	102.2	104.2	116.7	116.8
1955	110.4	113.9	106.7	107.7	119.3	119.5
1956	117.9	122.3	105.1	105.3	125.8	126.7
1957	116.4	121.1	93.6	94.9	124.2	126.6
1958	112.3	116.7	88.0	89.9	119.8	123.1
1959	115.4	120.3	91.5	91.3	121.7	124.9
1960	111.4	117.2	88.7	88.6	121.4	126.1
1961	110.2	115.2	86.8	85.5	121.6	126.1
1962	113.7	118.3	90.1	85.8	122.4	127.7
1963	118.9	123.7	92.7	89.1	122.9	128.5
1964	126.1	120.1	96.9	90.9	128.5	133.9
1965	134.7	139.1	98.9	92.2	132.2	138.1
1966	147.2	150.2	98.2	91.0	138.6	145.3
1967	147.6	151.1	97.4	90.0	139.4	146.2
1968	144.7	149.1	98.4	90.9	137.3	145.3

Table 3

	Printing, publishing & allied industries		Iron & steel mills		Agricultural implements	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	101.0	101.8	98.5	99.8	94.9	97.8
1951	103.9	103.9	112.9	114.8	101.3	103.9
1952	105.7	106.1	118.3	120.3	106.4	108.8
1953	106.9	108.5	117.7	120.1	79.3	85.4
1954	110.2	111.9	94.1	99.2	64.6	71.2
1955	111.1	113.6	107.3	111.7	64.6	70.9
1956	110.0	117.6	119.9	123.9	52.5	59.3
1957	110.6	117.7	117.5	123.5	55.9	61.9
1958	111.4	116.3	96.1	104.0	60.3	66.4
1959	111.7	117.5	112.7	120.1	76.2	81.9
1960	111.8	119.6	111.3	120.6	59.5	68.9
1961	107.9	117.8	108.8	117.9	52.8	66.2
1962	106.3	118.3	115.3	124.1	55.5	65.5
1963	105.8	118.0	119.2	129.5	65.2	73.5
1964	103.2	117.0	129.9	140.7	72.4	82.1
1965	105.7	122.0	139.6	150.2	80.2	90.3
1966	106.5	124.5	145.5	156.0	85.8	95.4
1967	109.2	125.4	138.2	149.9	78.0	95.8
1968	110.2	125.6	139.1	151.4	68.0	79.7

Table 3

	Motor vehicles		Motor vehicle parts and accessories		Smelting & refining	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	107.6	108.6	110.5	110.1	102.1	103.7
1951	112.5	112.8	117.8	118.4	116.4	119.1
1952	114 1	115.1	119.9	121.8	125.4	128.5
1953	121.8	122.0	128.2	130.4	128.2	131.1
1954	97.5	103.4	97.0	102.6	133.5	136.0
1955	118.4	123.7	105.8	111.7	146.6	149.4
1956	122.8	129.9	113.7	120.0	155.3	160.8
1957	113.2	122.8	105.6	114.1	147.8	154.6
1958	86.7	108.8	92.1	101.3	130.9	140.8
1959	96.4	105.3	97.1	105.5	137.1	144.9
1960	92.3	103.0	92.2	102.0	146.9	154.4
1961	76.6	84.1	122.5	136.8	141.4	150.6
1962	84.8	90.0	135.0	147.5	136.1	147.4
1963	100.3	104.6	156.2	169.0	129.7	143.5
1964	116.2	119.3	183.8	195.6	139.8	151.7
1965	139.4	142.6	198.4	212.5	146.7	160.2
1966	140.1	141.5	215.3	231.0	147.9	167.2
1967	137.9	139.8	215.8	231.6	157.1	174.9
1968	137.1	139.3	244.5	262.1	153.8	174.7

Table 3

	Electrical products		Cement manufacturers		Petroleum & coal products	
	Production labour	Total labour	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	106.7	107.8	103.7	103.6	97.3	104.3
1951	117.4	120.9	112.6	112.2	98.3	107.2
1952	116.4	123.8	129.3	130.0	105.2	116.2
1953	128.5	137.4	138.9	138.8	106.9	117.6
1954	118.7	134.3	145.5	150.5	106.9	120.7
1955	120.2	136.4	156.5	163.0	104.0	120.2
1956	133.0	149.0	175.3	187.0	105.4	121.5
1957	126.7	145.6	189.8	203.1	102.9	122.0
1958	113.4	134.0	181.5	201.3	97.8	119.8
1959	114.9	132.1	179.4	203.1	92.1	115.3
1960	108.9	127.8	171.3	196.3	91.7	115.5
1961	110.3	128.9	158.9	179.8	91.0	113.3
1962	123.3	139.2	163.4	184.3	87.8	109.1
1963	130.1	146.2	157.0	178.6	85.3	105.0
1964	136.2	151.7	155.5	180.0	83.9	104.3
1965	148.6	163.5	164.3	192.2	80.0	97.1
1966	165.4	180.1	175.0	203.1	80.0	98.0
1967	166.4	179.3	164.9	199.0	80.1	98.9
1968	162.4	179.4	155.5	187.7	80.6	97.9

Table 3

	Chemicals		All manufacturing	
	Production labour	Total labour	Production labour	Total labour
1949	100.0	100.0	100.0	100.0
1950	100.2	100.3	100.3	101.0
1951	111.8	110.4	106.4	107.4
1952	116 1	115.4	108.0	110.0
1953	122.0	121.4	110.9	113.3
1954	125.4	124.8	104.1	108.3
1955	123.8	125.4	106.5	110.9
1956	124.0	127.8	110.7	115.5
1957	125.9	132.3	110.0	116.0
1958	126.4	132.0	103.3	110.1
1959	125.4	132.5	105.1	111.3
1960	126.8	134.3	103.2	110.3
1961	122.4	130.1	106.3	102.3
1962	122.4	131.0	106.8	112.4
1963	126.0	134.7	110.0	115.3
1964	130.0	138.2	116.0	120.6
1965	135.8	144.4	122.4	127.0
1966	143.8	148.7	128.6	133.1
1967	145.2	145.6	128.1	133.7
1968	148.7	147.2	127.2	132.8

Table 4

Change in Employment, 1949 to 1968, and Difference Between Lowest and Highest Years

	1949 to 1968		Lowest to Highest Years			
	Production labour	Total labour	Production labour		Total labour	
Slaughtering and meat processors	+ 41.2%	+ 37.4%	45.4%	(1950, 1967)	40.2%	(1950, 1967)
Bakery products	+ 14.5	+ 11.2	20.9	(1950, 1967)	18.5	(1950, 1967)
Distelleries	+ 5.4	+ 31.0	60.0	(1963, 1956)	34.8	(1949, 1956)
Breweries	− 27.7	− 13.2	38.3	(1968, 1949)	20.7	(1962, 1956)
Tobacco products	− 18.5	− 13.4	22.7	(1968, 1949)	15.6	(1966, 1949)
Rubber industries	+ 1.2	+ 2.8	37.0	(1961, 1966)	24.4	(1962, 1966)
Cotton yarn and cloth mills	− 48.0	− 41.9	111.5	(1968, 1951)	88.8	(1968, 1951)
Synthetic textile mills	+ 11.1	+ 23.9	63.9	(1954, 1967)	58.1	(1954, 1967)
Clothing industries	+ 11.1	+ 2.3	15.8	(1959, 1966)	9.2	(1959, 1953)
Furniture and fixtures	+ 44.7	+ 49.1	49.4	(1952, 1967)	50.2	(1949, 1966)
Saw and planing mills	− 1.6	− 9.1	29.5	(1961, 1951)	30.5	(1961, 1951)
Pulp and paper mills	+ 37.3	+ 45.3	39.5	(1950, 1967)	46.2	(1949, 1967)
Printing, publishing and allied industries	+ 10.2	+ 25.6	11.8	(1949, 1960)	25.6	(1949, 1968)
Iron and steel mills	+ 39.1	+ 50.9	54.6	(1954, 1966)	57.4	(1954, 1966)
Agricultural implements	− 32.0	− 20.3	102.7	(1956, 1952)	83.5	(1956, 1952)
Motor vehicles	+ 37.1	+ 39.3	82.9	(1961, 1966)	70.0	(1961, 1965)
Motor vehicle parts and accessories	+144.5	+162.1	165.5	(1958, 1968)	162.1	(1949, 1968)
Smelting and refining	+ 53.8	+ 74.7	57.1	(1949, 1967)	74.9	(1949, 1967)
Electrical products	+ 62.4	+ 79.4	66.4	(1949, 1967)	80.1	(1949, 1966)
Cement manufacturers	+ 55.5	+ 87.7	89.8	(1949, 1957)	103.1	(1951) (1949, 1959) (1966)
Petroleum and coal products	+ 19.4	+ 2.1	31.5	(1965, 1953) (1966, 1954)	25.6	(1965, 1957)
Chemicals	+ 48.7	+ 47.2	48.7	(1949, 1968)	48.7	(1949, 1966)
All manufacturing	+ 27.2	+ 32.8	28.6	(1949, 1966)	33.7	(1949, 1967)

Little analysis is required because these raw data are provided for the reader's information if he wishes to consult them as he follows the exposition in subsequent chapters on labour productivity and unit costs.

The increase of 32.8 percent in total employment for all manufacturing from 1949 to 1968 compares with an increase of 44.9 percent for the industrial composite (forestry; mining, including milling; manufacturing; construction; transportation, communication and other utilities; trade; finance, insurance and real estate; and services). However, from 1961 to 1968, manufacturing kept pace with the industrial composite, the Statistics Canada employment indexes for 1968 (on a 1961 base) being 122.7 for the composite and 122.1 for manufacturing.[4]

Of course, employment trends showed great variation among the industries examined. Between 1949 and 1968 production-worker employment increased as much as 144.5 percent for motor vehicle parts and accessories while it decreased by 48.0 percent for cotton yarn and cloth mills,; total employment changes ranged from an increase as high as 162.1 for the same industry, motor vehicle parts and accessories, to a decrease of as much as 41.9 percent, also for cotton yarn and cloth mills.

The difference between employment in the highest and lowest years of the 1949-1968 period is shown in Table 4 for each industry. The low year is shown first in brackets, followed by the high year; in the case of cement manufacturers and petroleum and coal products, more than one year has the same high or low value. Where there was a steady growth in employment, the lowest year is likely to be 1949 or a year close to it and the highest year 1968 or one just preceding it; the converse applies in the case of a steady decline. The low and high years are the base and terminal years (1949 and 1968) or closely approximate them in: slaughtering and meat processors, bakery product, furniture and fixtures, pulp and paper mills, smelting and refining, electrical products, and chemicals. The converse (a high base year and low terminal year) is found in: breweries (for production labour only), tobacco products, and cotton yarn and cloth mills. In the other industries employment fluctuated sufficiently to display either a cyclical pattern or no pattern at all.

Because productivity and unit costs are examined on the basis of production workers and of total labour, a few comments on the relative employment trends of these kinds of labour are in order. It is readily apparent from Table 4 that total employment increased more rapidly or decreased less than employment of production workers. If nonproduction labour were examined separately, obviously the difference from production labour would be even greater.

In most industries there was a gradual increase in the proportion of nonproduction workers; in some the trend was rather strong, and only in a few was the trend downwards. The trend in each industry is examined in Table 5. For all manufacturing the proportion of production-worker employment declined only slightly, from 81.1 to 77.7 percent; however, for individual industries the proportion declined by as much as 19.6 percent (from 76.7 to 61.7) in distilleries and 18.9 percent (from 73.6 to 59.7 in 1967) in petroleum and coal products. In only four industries, slaughtering and meat processors, bakery products, clothing industries, saw and planing mills, was there an increase in the relative employment of production workers, but in the case of bakery products there was a zero trend rate of change; while there was a rather high actual trend value for slaughtering and meat processors, it was of little significance, as indicated by the low goodness of fit ratio.

For all manufacturing the proportion of nonproduction workers in 1968 was still only a little more than one-fifth, at 22.3 percent. But it ranged from a high of 51.2 percent in printing, publishing and allied industries, to a low of 6.7 percent in the clothing industries. By far the greatest increase in relative nonproduction-worker employment was in cement manufacturers, where it more than tripled, from 7.0 percent in 1949 to 23.0 percent in 1968; the annual trend rate of increase was 16.9 percent and was quite significant statistically, with an R value of .97. The fact that the trend rate of increase was greater for 16 of the 22 industries than it was for all manufacturing, combined with a definite and statistically significant decline for only two industries, clothing and saw and planing mills, suggests either that the increase in the relative employment of nonproduction workers must be less for many of the manufacturing industries not covered by this study or that the most pronounced trend towards employing relatively more nonproduction workers was in those industries with relatively light employment, thus influencing the trend for all manufacturing less than those industries where relative employment shifts were less pronounced.

In the following chapters productivity and unit costs of production are calculated separately for production labour and all labour. While we do not try to explain the differences in these measures, it is reasonable to speculate that the productivity of production labour alone may often increase more than that of all labour because of the contribution of professionals, technicians and other "nonproduction" specialists who are making up an increasing proportion of the labour force. It is a notion worthy of investigation in other research.

In Table 6 production-worker employment by number of workers is compared with employment by number of manhours paid for. Such a comparison is only possible for production-worker employment, which has been pointed out already, and only beginning with 1961. In most industries there was not very much difference, as can be seen from Table 7, where the 1968 index of production-worker employment is itself indexed on the index of manhours paid for. In only three industries, tobacco products, saw and planing mills, printing, publishing and allied industries, was the difference more than five percent; in seven industries the differences was less than one percent and in one industry, distilleries, there was no difference.

Table 5

Trend in the Proportion of Production and Nonproduction Workers to Total Employment, 1949-1968

	Production workers				Nonproduction workers					
	Proportion in		Change in	Rate[x]	Proportion in		Change in	Rate[x]	S	R
	1949	1968	proportion		1949	1968	proportion			
Slaughtering and meat processors	77.9	80.0	+ 2.8%	+ .9	22.1	19.9	− 10.0%	− .3	0.8	.45
Bakery products	85.0	87.6	+ 3.0	0	15.0	12.4	− 17.4	− .2	1.0	.21
Distilleries	76.7	61.7	−19.6	−1.2	23.3	38.3	+ 64.3	+ 5.7	3.2	.88
Breweries	81.0	67.5	−16.7	− .9	19.0	32.5	+ 71.0	+ 4.3	1.1	.97
Tobacco products	86.4	81.4	− 5.8	− .2	13.6	18.6	+ 36.8	+ 1.4	1.3	.65
Rubber industries	77.8	76.6	− 1.6	+ .1	22.2	23.4	+ 5.4	− .5	2.8	.23
Cotton yarn and cloth mills	91.6	82.1	−10.4	− .5	8.4	17.9	+113.1	+ 4.5	1.7	.84
Synthetic textile mills	84.3	75.6	−10.4	− .3	15.7	24.4	+ 55.4	+ 1.2	2.5	.49
Clothing industries	85.9	93.3	+ 8.6	+ .5	14.1	6.7	− 52.5	− 2.6	1.2	.89
Furniture and fixtures	84.8	82.3	− 3.0	− .1	15.2	17.7	+ 16.4	+ .4	0.9	.48
Saw and planing mills	80.2	86.8	+ 8.2	+ .5	19.8	13.2	− 33.4	− 1.9	1.7	.83
Pulp and paper mills	84.2	79.5	− 5.6	− .3	15.8	20.5	+ 29.7	+ 1.7	0.5	.95
Printing, publishing & allied industries	55.6	48.8	−12.3	− .8	44.4	51.2	+ 15.3	+ 1.0	0.7	.96
Iron and steel mills	89.1	81.9	− 8.1	− .4	10.9	18.1	+ 66.0	+ 3.1	1.1	.89
Agricultural implements	83 5	71.2	−14.7	− .7	16.5	28.8	+ 74.5	+ 3.1	3.0	.77
Motor vehicles	81.6	80.4	− 1.5	− .1	18.4	19.6	+ 6.5	+ .3	3.0	.13
Motor vehicle parts and accessories	84.6	79.0	− 6.6	− .4	15.4	21.0	+ 36.3	+ 1.6	2.0	.71
Smelting and refining	85.5	75.3	−12.0	− .6	14.5	24.7	+ 70.3	+ 3.4	0.9	.96
Electrical products	76.3	70.8(67)	− 7.2	− .5	23.7	29.2(67)	+ 23.2	+ 1.2	3.0	.53
Cement manufacturers	93.0	77.0	−17.2	−1.0	7.0	23.0	+228.5	+16.9	1.3	.97
Petroleum and coal products	73.6	59.7(67)	−18.9	−1.0	26.4	40.3(67)	+ 52.6	+ 2.1	2.1	.87
Chemicals	64.9	64.7(67)	− .3	− .4	35.1	35.3(67)	+ .5	+ 6.6	1.4	.68
All manufacturing	81.1	77.7	− 4.2	− .1	18.9	22.3	+ 18.0	+ .3	2.6	.16

[x]Computed by least squares of annual values. It refers to percentage rate of change in the proportion.

S — standard error of estimate

R — goodness of fit measure

Source D.B.S.: *Manufacturing Industries of Canada* Section A (Catalogue No. 31-203) (computations based on data on numbers of workers employed)

Table 6

Indexes of Production-Worker Employment, by Number of Workers Employed and by Manhours Paid For

	Slaughtering and meat processors		Bakery products		Distilleries		Breweries	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	95.5	96.0	97.4	97.7	95.3	92.2	92.5	94.1
1963	95.7	96.1	96.9	94.5	89.7	88.4	92.3	93.4
1964	97.8	98.3	97.6	96.0	91.6	90.4	90.3	92.0
1965	99.6	100.3	99.7	97.6	97.2	98.2	91.1	93.6
1966	99.3	110.1	104.6	100.9	106.3	105.1	90.7	91.5
1967	115.3	115.8	105.6	101.9	107.3	108.3	91.2	90.0
1968	112.9	112.3	102.3	99.3	106.5	106.5	90.2	90.8

	Tobacco products		Rubber industries		Cotton yarn and cloth mills		Synthetic textile mills	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	107.1	102.7	109.5	111.3	102.9	101.6	107.5	105.3
1963	109.2	101.6	118.0	118.0	101.1	101.9	114.4	114.1
1964	104.6	97.1	122.9	124.5	104.6	108.4	126.6	124.9
1965	100.3	94.7	127.1	126.7	104.9	106.9	130.4	126.7
1966	99.5	95.1	136.9	132.4	92.8	96.5	131.5	130.1
1967	100.2	95.1	128.6	125.2	98.0	97.7	135.4	131.3
1968	95.5	90.8	114.4	112.9	82.0	78.3	128.5	125.1

Source D.B.S.: *Manufacturing Industries of Canada,* Section A (Catalogue No. 31-203) (indexes derived from data in the report on numbers of workers and numbers of manhours)

Table 6

	Clothing industries		Furniture and fixtures		Saw and planing mills		Pulp and paper mills	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	99.9	102.6	103.2	116.0	103.7	109.1	100.5	101.4
1963	102.5	105.5	107.9	110.1	106.7	112.5	101.0	102.1
1964	108.0	110.8	114.4	116.6	111.5	118.8	105.6	107.8
1965	110.3	112.2	122.2	123.8	113.8	121.2	108.6	110.2
1966	112.2	114.0	133.6	134.7	113.1	120.0	113.9	116.2
1967	111.3	113.8	134.0	133.1	112.1	119.0	114.6	115.6
1968	111.2	113.8	131.3	129.6	113.3	119.9	112.8	113.3

	Printing, publishing and allied industries		Iron and steel mills		Agricultural implements		Motor vehicles	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	98.5	100.6	105.9	106.7	104.9	106.1	110.6	116.4
1963	97.9	101.8	109.5	112.7	123.4	128.2	130.9	138.8
1964	95.6	102.7	119.3	123.7	136.9	143.1	151.6	153.9
1965	97.9	106.0	128.2	130.1	151.7	155.9	181.9	189.0
1966	98.6	110.3	133.7	135.1	162.2	169.4	182.8	183.8
1967	101.1	112.7	127.0	127.3	147.5	170.6	179.9	182.9
1968	102.1	112.6	127.8	128.2	128.5	133.4	178.9	185.1

Table 6

	Motor vehicle parts and accessories		Smelting & refining		Electrical products		Cement manufacturers	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	110.1	115.1	96.2	96.0	111.8	112.5	102.8	102.9
1963	127.4	132.8	91.6	93.6	117.9	118.5	98.7	98.3
1964	149.9	158.0	98.8	101.3	123.4	126.2	97.8	97.8
1965	161.9	173.2	103.7	108.1	134.7	136.1	103.4	106.9
1966	175.6	180.6	104.6	105.4	149.9	152.4	110.0	111.2
1967	176.0	180.1	111.1	115.2	150.8	150.2	103.7	103.8
1968	199.5	210.7	108.7	107.5	147.2	148.5	97.8	98.1

	Petroleum and coal products		Chemicals		All manufacturing	
	No. of workers	Manhours paid for	No. of workers	Manhours paid for	No. of workers	Manhours paid for
1961	100.0	100.0	100.0	100.0	100.0	100.0
1962	96.4	97.2	99.9	99.2	100.5	105.2
1963	93.7	94.5	102.9	103.0	103.5	108.6
1964	92.2	93.9	106.1	106.3	109.1	115.0
1965	87.8	87.2	110.9	110.7	115.1	121.1
1966	87.9	90.2	117.4	117.3	121.0	126.9
1967	88.0	93.0	118.6	118.9	120.5	125.9
1968	88.5	94.1	121.4	122.2	119.7	124.9

Table 7

Employment by Number of Workers, 1968/1961,
Compared with Manhours Paid For

Slaughtering and meat processors	100.5
Bakery products	103.0
Distilleries	100.0
Breweries	99.3
Tobacco products	105.2
Rubber industries	101.3
Cotton yarn and cloth mills	104.7
Synthetic textile mills	102.7
Clothing industries	97.7
Furniture and fixtures	101.3
Saw and planing mills	94.5
Pulp and paper mills	99.6
Printing, publishing & allied industries	90.7
Iron and steel mills	99.7
Agricultural implements	96.3
Motor vehicles	96.7
Motor vehicle parts and accessories	94.7
Smelting and refining	101.1
Electrical products	99.1
Cement manufacturers	99.7
Petroleum and coal products	94.0
Chemicals	99.3
All manufacturing	95.8

If the number of workers increases more than the number of manhours, productivity shows a greater increase when expressed as output per manhour than as output per worker. In fact, the relative difference between the two measures of labour productivity is equal to the relative difference between the two measures of employment.[5] Therefore, only if there is a substantial difference between the two measures of employment, can we expect much difference between the alternative measures of change in labour productivity. It is worth repeating that the alternative measures of labour input have no bearing on calculations of unit labour cost because only the employer outlay for labour (the wage bill) is compared with change in physical output.[6]

Wages and salaries

To measure trends in labour productivity it is necessary to compare changes in total output with changes in total employment. For a similar measure of unit labour cost it is necessary to compare changes in total output with changes in total compensation to labour (be it wages only for production workers or aggregate wages and salaries for all workers).

Table 8 contains indexes of total wages and of total wages and salaries, and is comparable to Table 2 covering production and Table 3 covering employment. The data in Table 8 are indexes of the total wage bill or wage and salaries bill for each industry for each year, they are not indexes of wages or of wages and salaries per worker. As might be expected, the highest index for almost every industry is 1968 or a year or two immediately preceding. In many industries this is because increasing total employment combined with rising wages and salaries per worker, and even in industries where total employment declined, the decline was not sufficient to offset the increase in compensation per worker.

In 15 of the 22 industries and in all manufacturing total wages and salaries increased faster than total wages alone. For all manufacturing, by 1968, total wages and salaries had increased 6.4 percent more, since 1949, than wages only. For the 15 industries the average margin over wages alone was 17.6 percent, with, however, a wide variation shown. Here is the percentage margin for each industry:

distilleries – 17.0
breweries – 20.0
tobacco products – 7.2
rubber industries – 1.7
cotton yarn and cloth mills – 18.7
synthetic textile mills – 22.7
furniture and fixtures – 2.7
printing, publishing & allied industries – 14.6
iron and steel mills – 20.5
agricultural implements – 11.1
motor vehicle parts & accessories – 59.8
smelting and refining – 17.2
electrical products – 7.9
cement manufacturers – 25.5
petroleum and coal products – 17.9

There were seven industries where the increase in the total wage bill between 1949 and 1968 exceeded that for total wages and salaries. The average excess was 4.3 percent, and, except for clothing and chemicals, the percentages were all small, as the following illustrates:

slaughtering and meat processors – 3.9
bakery products – 4.1
clothing industries – 11.8
saw and planing mills – 2.1
pulp and paper mills – 0.7
motor vehicles – 0.7
chemicals – 7.0

It might be an interesting exercise to try to explain these different movements of wages and of salaries because it might shed light on changes in technology, organization and methods, and help explain differential trends in productivity. However, the differences are mentioned here only because they have an important bearing on different trends in unit labour costs for production labour only and for total labour.

While it is essential to the computation of unit labour cost indexes to have indexes of total labour compensation, as provided in Table 8, it aids in the understanding of the relation between movements in productivity, unit costs and unit prices to analyze changes in the components of compensation per worker. It was not possible for salaried (i.e. nonproduction) workers alone but it was for production workers.

Table 8

Indexes of Total Wages for Production Workers, and Total Salaries and Wages

	Slaughtering and meat processors		Bakery products		Distilleries		Breweries	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	104.1	104.6	104.8	104.1	107.8	106.7	97.1	101.8
1951	118.7	119.1	116.9	116.0	135.6	130.8	112.2	117.2
1952	140.8	136.9	129.6	128.0	151.2	142.9	127.2	128.5
1953	143.7	142.8	141.5	139.6	169.1	156.0	134.3	135.3
1954	148.9	150.9	145.2	143.5	179.1	162.9	138.4	142.5
1955	159.9	159.2	153.3	150.2	200.3	178.4	139.5	146.6
1956	175.9	173.5	163.5	159.7	222.9	195.4	146.5	156.7
1957	181.9	181.1	172.4	169.5	223.5	202.0	150.3	157.7
1958	198.6	196.9	183.4	180.4	225.2	207.2	151.7	160.7
1959	227.9	222.4	192.9	189.3	227.2	214.8	161.7	172.0
1960	225.5	222.9	200.5	198.6	213.0	211.8	164.0	179.5
1961	223.4	222.7	203.8	199.8	202.4	216.2	159.1	174.3
1962	223.1	221.2	212.1	212.0	199.8	220.3	153.7	173.4
1963	227.3	222.9	218.0	216.7	197.9	224.0	155.6	180.4
1964	242.9	238.5	231.7	228.9	211.5	238.4	158.4	188.5
1965	257.3	257.4	246.4	246.0	241.5	272.7	169.4	203.2
1966	273.0	271.4	268.0	261.4	272.2	306.6	180.4	218.0
1967	340.4	325.4	287.5	277.4	294.3	334.5	186.6	227.1
1968	353.2	339.8	301.3	289.3	313.7	366.9	205.4	246.4

Source D.B.S.: *Manufacturing Industries of Canada,* Section A (Catalogue No. 31-203)
(indexes derived from data in the report on wages and salaries)

Table 8

	Tobacco products		Rubber industries		Cotton yarn and cloth mills		Synthetic textile mills	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	102.1	103.3	115.2	112.6	111.0	111.9	105.9	111.0
1951	109.5	111.6	135.0	133.6	116.9	119.0	118.6	123.7
1952	114.3	116.0	134.7	135.9	103.5	108.8	107.2	118.2
1953	121.9	122.2	147.2	147.4	106.1	111.5	111.9	121.6
1954	128.3	127.3	137.6	140.1	93.7	100.2	96.3	112.5
1955	136.2	134.5	153.2	153.1	103.1	114.3	111.6	129.9
1956	139.5	138.4	170.4	170.5	107.1	120.5	115.1	136.0
1957	152.6	152.2	168.3	172.7	101.8	116.0	119.7	141.3
1958	168.4	169.6	151.1	158.7	91.1	108.4	112.1	136.6
1959	170.8	173.9	175.1	180.3	92.2	108.0	121.7	148.5
1960	169.3	175.2	167.4	175.4	93.7	107.9	130.3	155.2
1961	173.1	178.8	167.4	170.4	99.7	113.1	133.3	167.8
1962	184.0	194.1	193.0	166.7	108.1	121.0	147.3	182.6
1963	195.0	195.9	209.1	200.2	110.8	125.2	167.5	202.1
1964	197.3	202.4	230.9	223.9	125.4	139.4	195.5	231.2
1965	203.3	207.2	250.1	244.3	128.9	143.2	207.6	248.2
1966	212.5	218.1	279.0	267.1	123.4	141.2	220.4	269.5
1967	230.3	243.8	284.1	280.0	135.6	156.4	233.4	280.7
1968	243.2	260.6	271.0	275.6	116.8	138.6	251.8	309.0

Table 8

	Clothing industries		Furniture & fixtures		Saw & planing mills		Pulp & paper mills	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	101.6	102.8	105.7	106.9	112.4	112.8	106.9	107.3
1951	106.1	106.6	112.2	114.8	131.2	131.2	135.3	135.2
1952	119.6	117.8	119.5	123.3	134.4	136.1	141.9	142.9
1953	126.9	124.3	138.4	141.6	141.2	144.2	148.7	149.5
1954	119.2	117.8	140.9	144.8	139.0	142.0	159.5	160.2
1955	122.8	120.8	152.5	157.0	151.3	155.6	167.6	168.2
1956	130.8	128.1	169.8	174.2	153.0	158.5	186.9	188.7
1957	135.4	134.7	175.1	182.0	143.3	149.0	189.9	195.1
1958	135.2	134.1	173.5	181.9	144.2	150.1	186.6	194.9
1959	140.1	138.1	188.0	197.9	147.1	153.9	196.0	204.4
1960	141.7	142.0	185.7	196.6	152.4	159.0	207.9	219.3
1961	151.1	147.5	188.8	199.2	155.4	161.3	216.7	213.0
1962	161.2	152.6	205.4	213.1	171.8	171.9	225.2	222.5
1963	170.5	159.4	220.6	236.7	186.8	188.3	231.8	229.0
1964	187.4	172.6	245.6	252.3	203.2	201.3	252.5	247.6
1965	200.7	185.1	274.1	279.6	219.9	215.7	271.1	266.2
1966	216.0	196.7	318.3	323.5	234.7	229.5	312.2	305.5
1967	225.9	205.1	335.1	343.6	248.2	243.0	330.4	324.6
1968	243.9	218.2	351.4	361.0	271.5	265.9	349.3	346.9

Table 8

	Printing, publishing & allied industries		Iron & steel mills		Agricultural implements		Motor vehicles	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	108.5	108.5	101.5	103.0	97.5	97.9	123.8	123.1
1951	119.5	120.0	128.4	130.9	119.4	118.1	133.0	132.2
1952	132.1	133.6	147.5	149.9	143.1	141.2	146.7	148.1
1953	146.9	147.6	153.1	156.4	107.8	113.8	173.9	171.2
1954	154.5	158.1	122.2	131.2	82.1	91.0	127.9	138.3
1955	166.4	169.7	159.2	165.0	88.3	94.8	167.6	175.6
1956	172.8	182.6	190.5	196.3	74.6	83.0	185.7	195.5
1957	182.1	192.9	195.0	205.9	80.7	88.8	170.7	187.3
1958	194.1	201.0	161.4	178.4	98.3	107.1	148.7	169.2
1959	201.9	213.0	205.9	220.5	130.7	139.6	173.6	191.6
1960	207.8	225.3	206.0	224.9	104.6	123.4	178.0	197.4
1961	207.6	229.1	210.5	230.3	92.2	116.0	147.9	161.8
1962	217.7	237.3	228.5	248.7	103.5	122.5	184.3	189.8
1963	219.7	243.2	248.9	271.4	130.7	146.2	234.1	234.9
1964	222.6	246.0	277.1	300.9	152.7	171.4	264.5	266.1
1965	239.4	269.9	305.3	329.5	166.9	189.4	353.6	340.9
1966	252.7	290.3	326.6	356.2	190.5	213.5	352.6	352.2
1967	270.3	310.7	327.0	363.0	197.5	223.5	359.1	357.7
1968	288.4	330.4	346.2	384.8	164.0	197.6	413.7	410.9

Table 8

	Motor vehicle parts and accessories		Smelting and refining		Electrical products		Cement manufacturers	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	124.2	122.8	105.6	106.6	112.5	113.2	110.3	110.3
1951	143.2	143.0	136.2	136.9	137.1	141.9	131.2	131.2
1952	158.3	159.0	158.4	159.5	149.0	158.5	164.2	164.9
1953	175.2	177.8	170.2	171.4	168.0	182.5	186.3	186.4
1954	134.1	143.5	182.1	186.1	163.3	188.3	199.2	206.5
1955	152.7	163.3	208.6	214.4	166.5	192.3	220.4	231.1
1956	169.5	180.4	230.2	236.0	197.9	226.2	252.9	274.1
1957	164.7	181.6	232.8	244.4	194.3	233.4	296.5	326.2
1958	150.6	170.2	215.8	237.8	183.2	230.4	296.0	340.5
1959	169.1	186.6	232.4	248.9	187.7	230.8	302.7	357.5
1960	167.1	187.7	262.1	277.5	184.9	232.8	298.2	356.4
1961	227.0	260.5	257.8	279.4	187.1	235.7	293.8	347.6
1962	268.0	297.1	252.4	276.7	215.0	260.2	312.4	372.5
1963	324.3	350.6	244.0	278.5	234.1	280.0	307.7	371.1
1964	400.5	428.4	274.3	305.2	255.3	301.9	317.0	384.3
1965	467.9	502.8	302.6	337.1	288.2	336.1	368.0	440.9
1966	488.8	527.7	316.2	366.6	335.0	386.0	408.9	487.3
1967	506.8	548.5	369.2	413.5	347.9	399.2	396.9	494.4
1968	667.2	714.8	374.7	439.1	369.9	399.1	402.8	505.7

Table 8

	Petroleum and coal products		Chemicals		All manufacturing	
	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages	Total production wages	Total salaries & wages
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	103.8	111.7	106.1	106.1	105.9	106.9
1951	119.8	130.6	133.1	130.4	125.3	126.4
1952	145.3	159.8	149.6	147.1	138.2	140.3
1953	153.1	167.3	166.5	163.5	149.8	152.7
1954	156.6	175.2	176.6	176.1	143.7	150.3
1955	158.5	182.1	181.5	184.0	152.6	159.8
1956	173.3	205.3	191.1	199.4	168.0	176.3
1957	187.5	222.9	209.1	220.5	174.0	186.9
1958	181.7	224.9	213.4	232.2	169.8	185.3
1959	183.5	236.0	226.7	241.5	180.5	195.7
1960	190.2	243.9	239.9	256.8	183.0	200.5
1961	191.9	247.1	239.3	258.6	193.2	186.9
1962	194.0	247.5	247.3	269.7	203.2	217.7
1963	193.1	244.8	263.6	287.1	217.0	232.0
1964	199.4	254.6	280.8	304.9	239.1	252.9
1965	193.2	251.6	302.6	330.9	265.6	279.4
1966	217.2	275.2	340.2	361.9	295.4	310.6
1967	233.6	295.0	365.8	364.3	310.9	330.5
1968	252.5	297.7	401.4	375.3	332.7	354.0

In Table 9 the first column for each industry contains indexes of wages per worker (i.e. the total wage bill divided by total wage-earner employment). These indexes are based on annual values, aggregate payroll for the entire year, divided by total employment. Wage earners, or production workers, as they are called here, are ordinarily paid by the hour and even if they are on piecework or an incentive pay system, their pay can be expressed in hourly terms. The compensation such workers receive in a year depends primarily on how many hours they are paid for, including the number for which pay is at a premium rate such as time and one-half or double time; it also depends on bonuses they might receive, etc. Statistics Canada publishes monthly data on average hourly earnings, each figure representing the pay received by employees in one week of the month, divided by the number of hours paid for in the week (the number of hours consisting not only of those that are worked but those that are paid for but not worked, such as holidays and vacations). Simple averages of the twelve monthly figures are published to provide average hourly earnings figures for each year for each industry.[7]

From Table 9 we can compare the index of annual wages per worker with that of average hourly earnings. Where the hourly earnings index rose faster it suggests that either hours paid for were decreasing from year to year (weekly pay remaining constant) or the number of hours paid for at premium time was increasing, or at some time during the year the hourly wage rate was increased sufficiently to raise the hourly earnings annual average, hence the index, more than the value for annual compensation per worker.

In addition to these factors, a change in the skill-mix of the labour force - say, a shift towards more employment of more skilled, more highly paid workers - can enhance the indexes of annual wages or hourly earnings per worker. If we are to know how much payroll has increased because of straight increases in wage rates, we need a measure of change in occupational wage rates. Such an index is prepared by the Canada Department of Labour, covering production worker jobs.[8] This appears in the third column for each industry in Table 9. These indexes are then analyzed in Table 10 and trend rates of change per annum, in Table 11.

These tables (and most of the others in this chapter) are here primarily for the use of the researcher who wants to examine the position of and trends in labour productivity and unit costs more fully than is possible in this study. For example, any research into possible relations between changes in productivity and wages requires the data in Tables 9 and 10; similarly, as regards further research into the relation between wages and prices.[9] Therefore, discussion here is limited to a few observations.

The first column of Table 10 compares the change in annual wages per worker (1968 over 1949) for each industry with the average for all manufacturing. Ten of them were in excess of the all-manufacturing average (that is, the relative index had a value of more than 100.0), eleven fell below, and one was exactly in line. This is not a comparison of levels of wages, but of increases; thus, iron and steel mills which, in 1968 paid wages higher than the all-manufacturing average, showed an increase in annual wages per worker that was less than the average increase, while saw and planing mills, with somewhat below average wages, had an above-average increase in annual wages per worker. Of course, what has just been said and what immediately follows might not apply if the comparisons were between years other than 1949 and 1968.

In the second column of Table 10, increases in average hourly earnings, as reported by Statistics Canada (see reference in footnote 7), are compared with increases in annual wages per worker. This comparison was not possible for distilleries, motor vehicle parts and accessories, and cement manufacturers. For the other 19 industries 14 showed a greater increase in average hourly earnings, with the other five, of course, showing a lesser increase, while for all manufacturing the hourly figure increased very slightly less than the annual one. The factors that would cause the one index to differ from the other have already been mentioned. No doubt the reduction of the standard work week (number of hours normally worked per week) was an important factor. An exact comparison between 1949 and 1968 is not possible but it is known that the standard work week for male nonoffice employees in manufacturing averaged 45.0 hours in 1949 and 41.1 in 1965.[10] In 1968 and the years immediately preceding, much overtime, at premium rates, was worked in some industries; there would have been less of this in 1949 because the standard work week was longer and also because the economy was operating under less pressure.

The other important reason for a difference between the hourly and annual series is a change in the straight-time rate of pay. Since most increases do not take effect on the first day of the year, it means that the later in the year the increase is put into effect, the smaller its influence on total wages received in the year. The index of hourly earnings, used in computing column (2), is based on a simple average of the 12 monthly figures, while the index of wage rates used for computing column (3) is based on wages paid on October first of each year. The values in column (3) are lower than the values in column (2) for 14 of the 19 industries for which information was available, and the value is also lower for all manufacturing. This suggests that premium rates for overtime work and/or enrichment of the skill-mix are part of the reason for the rise in average annual wages per worker.

Table 9A

Annual Wages, Hourly Earnings, Wage Rates, 1949 to 1968

	Slaughtering and meat processors			Bakery products			Distilleries		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0		
1950	104.9	105.6	106.0	107.1	105.1	105.6	104.5		
1951	117.5	120.7	125.4	116.4	116.6	115.5	114.8	Not available	
1952	124.9	131.1	139.6	126.2	125.6	125.2	123.7		
1953	127.9	136.7	136.3	133.4	133.3	130.6	127.8		
1954	134.1	141.5	138.5	138.1	138.4	134.6	138.6		
1955	138.9	146.2	144.2	144.2	142.3	139.4	149.9		
1956	146.9	149.0	151.2	149.6	152.5	150.0	156.9		
1957	150.2	157.2	161.4	158.2	164.1	159.1	165.8		
1958	159.7	162.2	169.7	168.0	171.7	168.3	177.1		
1959	171.7	170.7	170.8	173.9	180.7	172.5	188.9		
1960	175.3	181.1	181.6	177.3	187.1	178.4	193.2		
1961	178.7	188.6	187.3	182.1	192.3	183.4	204.6		
1962	186.9	194.3	192.7	194.4	197.4	189.3	211.6		
1963	189.9	199.0	193.8	200.9	208.9	198.9	222.7		
1964	198.6	202.8	197.7	212.1	220.5	205.1	233.3		
1965	206.5	213.2	206.9	220.8	229.4	214.9	251.1		
1966	219.7	218.2	209.5	228.8	242.3	228.3	258.7		
1967	236.0	248.1	247.6	243.1	261.5	252.1	277.1		
1968	250.1	266 0	258.2	263.1	284.6	278.5	297.6		

Sources: Annual wages per worker — D.B.S.: *Manufacturing Industries of Canada,* Section A (Catalogue No. 31-203)
Average hourly earnings — D.B.S.: *Man-Hours and Hourly Earnings,* (Catalogue No. 7203)
Wage rate index — Canada Dept. of Labour: Wage Rates, Salaries and Hours of Labour.

Table 9A

	Breweries			Tobacco products			Rubber industries		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	101.2	104.6	105.3	106.8	110.4	110.9	108.7	105.7	105.1
1951	118.9	114.9	117.7	121.0	129.0	135.1	122.6	120.0	124.3
1952	137.0	132.7	131.9	134.1	144.1	141.0	133.6	128.5	127.4
1953	142.0	140.1	148.1	137.0	151.1	152.0	139.4	136.1	134.9
1954	143.1	153.2	152.9	143.6	156.9	155.0	139.9	139.0	138.1
1955	149.9	158.8	157.9	151.3	161.6	160.3	147.5	141.9	139.6
1956	153 7	168.2	168.6	153.5	165.1	164.8	156.0	149.5	145.0
1957	162.9	180.3	181.3	164.0	177.9	174.6	161.9	158.0	150.4
1958	170.4	188.7	188.1	174.8	183.7	184.4	165.3	162.8	153.2
1959	186.7	200.0	198.1	179.4	194.1	193.3	179.3	170.4	160.2
1960	197.7	210.2	207.8	191.5	200.0	198.0	178.4	174.2	164.3
1961	198.5	218.6	217.7	202.8	210.4	207.1	189.2	179.0	167.0
1962	207.4	220.5	221.7	201.2	215.1	216.6	199.2	184.7	169.1
1963	210.2	229.9	228.9	209.1	229.0	240.5	200.2	189.5	177.0
1964	218.8	239.2	238.1	220.9	245.3	248.7	212.4	198.0	180.1
1965	231.9	244.8	247.5	237.4	258.1	264.4	222.3	206.6	192.3
1966	248.1	261.6	261.6	250.2	279.0	276.2	230.3	220.9	201.2
1967	255.1	279.4	275.1	269.2	295.3	291.5	249.7	237.1	214.9
1968	284.1	294.3	295.2	298.2	323.2	323.9	267.7	247.6	234.4

Table 9A

	Cotton yarn & cloth mills			Synthetic textile mills			Clothing industries		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	103.7	104.7	105.3	102.6	103.5	103.1	102.4	103.9	102.5
1951	106.2	117.6	117.1	114.2	116.4	115.7	107.3	114.4	112.8
1952	117.0	123.5	127.5	123.1	125.8	120.1	114.9	121.0	119.6
1953	119.0	129.4	128.7	127.5	129.4	124.3	120.1	126.3	124.9
1954	124.1	130.5	129.5	134.0	135.2	125.4	117.5	130.2	126.8
1955	129.7	132.9	131.5	136.8	138.8	125.3	123.7	128.9	129.7
1956	132.3	136.4	138.6	139.2	144.7	128.1	131.4	132.8	136.4
1957	131.2	142.3	143.0	151.1	151.7	133.8	134.3	138.1	144.0
1958	130.9	145.8	145.8	148.4	157.6	140.3	139.0	142.1	149.1
1959	141.1	150.5	151.0	156.2	162.3	145.4	144.6	146.0	153.4
1960	153.8	158.8	160.2	162.6	167.0	151.1	145.5	152.6	156.2
1961	157.0	164.7	164.8	154.1	170.5	157.0	151.2	157.8	161.5
1962	165.3	170.5	171.9	158.4	177.6	166.7	161.4	161.8	164.8
1963	172.2	176.4	175.1	169.2	184.7	172.6	166.4	168.4	172.9
1964	188.8	185.8	185.6	178.4	195.2	180.7	173.6	176.3	177.7
1965	193.4	195.2	192.1	184.0	207.0	182.4	182.1	184.2	186.6
1966	209.4	207.0	211.2	193.7	221.1	195.1	192.6	196.0	191.7
1967	217.8	224.7	225.2	199.2	236.4	214.7	203.2	210.5	200.9
1968	224.4	238.8	234.0	226.5	257.6	226.5	219.5	227.6	219.1

Table 9A

	Furniture & fixtures			Saw & planing mills			Pulp & paper mills		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	104.5	104.6	104.6	105.1	105.2	108.3	106.9	104.3	106.0
1951	112.6	112.7	113.7	116.6	119.7	123.4	123.8	121.9	128.1
1952	120.9	122.0	119.7	123.9	128.1	132.3	128.6	132.4	130.6
1953	127.5	127.9	126.0	129.6	134.3	133.4	133.5	142.9	139.8
1954	130.4	132.5	126.8	136.0	139.5	134.3	136.6	150.8	146.9
1955	138.1	137.2	131.1	141.8	142.7	138.1	140.4	157.0	153.6
1956	143.9	143.0	137.5	144.5	148.9	144.6	148.5	166.6	165.2
1957	150.4	150.0	145.2	153.0	156.2	155.5	152.8	176.3	174.1
1958	154.5	155.8	151.6	163.7	162.5	156.8	155.7	182.4	177.0
1959	162.8	160.4	157.5	160.7	163.5	163.2	160.9	188.5	180.7
1960	166.6	166.2	163.1	171.9	185.4	166.7	171.2	196.4	189.0
1961	171.3	169.7	166.2	178.9	189.5	169.3	178.1	206.1	197.2
1962	180.5	173.2	168.7	190.6	193.7	173.7	183.9	212.2	203.7
1963	185.4	180.2	173.8	201.4	203.1	181.8	188.5	217.5	206.1
1964	194.7	186.0	178.8	209.8	211.4	192.7	196.4	223.6	209.5
1965	203.4	195.3	188.8	222.3	217.7	202.9	205.0	232.4	224.4
1966	216.2	208.1	203.4	238.9	233.3	216.8	225.2	256.1	242.3
1967	226.9	222.0	220.0	254.6	252.0	233.1	236.9	272.8	262.8
1968	242.8	238.3	237.9	275.8	271.8	253.7	254.3	289.4	276.0

Table 9A

	Printing, publishing & allied industries			Iron & steel mills			Agricultural implements		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1950	107.3	107.8	108.1	103.0	106.7	106.4	102.6	109.5	110.5
1951	114.9	116.6	117.2	113.6	120.1	123.7	117.9	127.8	133.9
1952	124.9	130.7	130.0	124.6	134.4	131.6	134.4	139.1	137.3
1953	137.4	139.4	137.3	130.1	142.8	137.3	135.9	140.0	138.9
1954	140.1	145.6	142.8	129.8	143.6	140.1	127.2	142.6	142.5
1955	149.7	151.7	146.9	148.2	152.1	148.9	136.7	146.0	144.6
1956	156.9	158.7	152.5	158.9	165.5	165.3	142.2	148.6	143.5
1957	164.5	165.7	159.5	165.9	180.6	176.0	144.4	156.5	152.0
1958	174.3	173.6	166.3	168.0	189.0	177.8	163.0	166.0	162.1
1959	180.7	182.4	174.2	182.7	198.3	185.6	171.6	175.6	161.1
1960	185.9	191.2	181.3	185.1	205.8	197.4	175.9	183.4	173.4
1961	192.3	196.4	186.9	193.4	214.2	198.8	174.2	191.3	184.8
1962	204.7	204.3	195.2	198.1	218.4	205.7	204.3	196.5	188.2
1963	207.7	211.4	201.2	208.9	224.3	208.8	200.1	206.9	201.3
1964	215.7	218.4	209.1	213.3	226.8	210.0	204.7	214.7	206.4
1965	226.5	227.1	218.6	218.8	237.8	228.2	208.0	223.4	218.8
1966	237.2	238.5	227.0	224.5	247.0	231.6	222.0	237.3	236.1
1967	247.4	251.7	238.2	236.6	261.3	244.7	253.1	246.9	245.0
1968	261.6	268.4	254.9	248.8	275.6	255.4	241.3	260.8	268.8

Table 9A

	Motor vehicles			Motor vehicle parts and accessories			Smelting & refining		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0
1950	114.9	105.3	105.0	112.4	Not	106.2	103.4	104.6	–
1951	118.2	113.7	116.0	121.5	available	127.8	117.0	121.4	123.6
1952	128.5	125.1	125.7	131.9		136.1	126.2	137.3	132.2
1953	142.6	129.0	129.8	136.6		140.5	132.7	142.9	142.9
1954	131.1	130.5	130.0	138.3		144.5	136.3	149.5	145.4
1955	141.4	137.4	134.1	144.3		147.1	142.3	155.1	149.4
1956	150.6	143.5	142.7	149.1		157.4	148.1	161.6	153.7
1957	150.7	151.1	152.6	156.0		166.2	157.4	171.9	166.0
1958	171.5	156.4	156.6	163.5		170.6	164.8	181.3	175.3
1959	179.9	167.9	164.1	174.1		179.1	169.4	185.9	179.1
1960	192.6	173.2	170.6	181.3		180.4	178.4	184.1	184.4
1961	192.8	180.1	176.2	185.2		186.3	182.2	189.7	187.0
1962	217.2	190.8	179.9	198.5		188.0	185.4	193.4	189.3
1963	233.2	200.0	188.2	207.5		192.7	188.1	200.9	191.7
1964	227.5	204.5	196.5	217.9		199.5	196.1	205.6	200.3
1965	253.4	219.0	209.1	235.7		207.7	206.2	211.2	–
1966	251.5	224.4	225.1	227.0		223.7	213.7	225.2	–
1967	260.3	236.6	237.1	234.8		241.8	237.7	238.3	–
1968	301.6	266.4	256.1	272.8		257.6	243.5	257.9	–

Table 9A

	Electrical products			Cement manufacturers			Petroleum & Coal products		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0			100.0	100.0	100.0
1950	105.4	105.5	106.9	106.3			106.6	105.6	–
1951	116.7	118.3	122.1	116.6			121.8	124.3	124.9
1952	128.0	128.4	130.1	127.0	Not available		138.1	140.6	137.6
1953	130.8	132.1	134.6	134.1			143.2	147.1	143.4
1954	137.6	137.6	139.5	136.9			146.4	153.6	147.5
1955	138.4	138.5	142.8	140.8			152.2	159.3	154.0
1956	148.7	145.8	149.9	144.2			164.4	169.1	164.0
1957	155.1	152.2	160.2	156.2			182.1	181.3	176.1
1958	161.5	157.7	166.2	163.0			185.7	186.9	178.4
1959	163.3	163.3	170.9	168.7			199.1	198.3	185.2
1960	169.7	168.8	172.3	174.0			207.5	204.8	194.3
1961	169.6	173.3	176.2	184.8			210.8	208.9	196.1
1962	174.3	176.1	180.3	191.2			220.9	217.8	203.2
1963	179.9	179.8	187.5	196.0			226.4	224.3	209.6
1964	187.5	186.2	194.2	203.8			237.4	231.7	217.0
1965	193.9	193.5	186.5	223.9			241.6	236.5	220.8
1966	202.4	203.6	197.8	233.7			271.3	259.3	241.3
1967	209.0	213.7	217.4	240.6			291.5	274.7	257.6
1968	227.8	230.1	235.7	259.0			313.4	295.1	273.1

Table 9A

	Chemicals			All manufacturing		
	Annual wages per worker	Average hourly earnings	Wage rate index	Annual wages per worker	Average hourly earnings	Wage rate index
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	105.9	106.0	–	105.5	105.0	105.8
1951	119.0	121.2	121.5	117.7	119.1	120.3
1952	128.8	134.3	133.1	128.0	131.3	128.4
1953	136.4	139.3	139.6	135.0	137.3	134.6
1954	140.7	146.4	146.2	137.9	142.4	138.5
1955	146.5	152.5	150.3	143.2	146.4	142.2
1956	154 1	161.6	160.2	151.6	153.5	149.8
1957	166.0	173.7	169.4	158.0	162.6	148.6
1958	168.7	183.8	177.3	164.2	167.6	164.2
1959	180.7	189.8	183.0	171.7	173.7	169.9
1960	189.1	200.0	189.0	177.2	180.8	175.0
1961	195.4	206.0	195.7	181.7	184.8	179.5
1962	202.0	213.1	199.7	190.1	189.8	184.5
1963	209.1	221.2	207.1	197.2	196.9	190.5
1964	216.0	227.2	212.5	206.2	204.0	197.2
1965	222.7	234.3	221.5	217.0	214.1	206.4
1966	236.6	244.4	238.5	229.6	227.2	218.2
1967	251.8	262.6	265.5	242.6	242.4	234.2
1968	270.0	279.7	275.7	261.5	260.6	252.3

Table 9B

Annual Wages and Salaries per Worker, 1949 to 1968

	Slaughetring & meat packing	Bakery products	Distilleries	Breweries	Tobacco products	Rubber industries
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	104.9	106.9	104.4	106.0	107.0	107.1
1951	117.3	116.1	113.6	120.0	121.4	120.1
1952	123.3	125.7	120.4	136.2	133.6	130.6
1953	128.4	133.2	123.1	139.6	137.6	135.2
1954	135.1	137.6	130.1	144.3	143.6	139.0
1955	138.6	142.5	138.9	151.5	150.8	144.9
1956	144.8	147.6	145.0	155.4	153.9	152.8
1957	148.6	156.4	155.1	162.2	164.2	161.4
1958	157.7	167.1	166.0	170.7	175.7	164.9
1959	170.4	172.2	177.4	185.3	180.6	177.2
1960	175.7	177.0	186.5	197.5	192.4	179.1
1961	179.2	181.5	198.7	197.8	202.4	169.5
1962	185.2	193.4	205.2	207.6	204.9	194.9
1963	188.4	200.3	215.2	214.3	209.2	198.5
1964	195.9	209.6	225.7	220.8	219.0	210.6
1965	206.6	219.8	242.9	232.4	237.6	220.6
1966	217.0	227.3	250.6	251.4	242.1	227.7
1967	232.8	240.4	264.2	264.1	271.6	248.2
1968	247.3	260.1	280.1	284.0	301.1	268.1

Soure D.B.S.: Manufacturing Industries of Canada, Section A (Catalogue No. 31–203)
(indexes derived from data in the report)

Table 9B

	Cotton yarn and cloth	Synthetic textile mills	Clothing industries	Furniture & fixtures	Saw and planing mills
1949	100.0	100.0	100.0	100.0	100.0
1950	104.4	104.1	103.1	105.4	106.2
1951	108.4	115.7	107.5	113.0	117.5
1952	119.3	126.5	113.9	121.4	124.3
1953	121.1	130.2	118.6	127.7	130.5
1954	127.0	138.5	119.9	130.6	136.2
1955	133.6	141.9	123.0	137.9	144.5
1956	138.2	145.8	130.2	142.4	150.6
1957	138.2	155.9	135.0	150.3	157.0
1958	140.5	159.3	139.5	155.8	167.0
1959	149.4	166.6	143.8	164.6	168.6
1960	161.4	171.8	147.5	167.7	179.5
1961	163.7	175.0	150.8	172.9	188.6
1962	170.8	178.3	158.9	180.1	200.4
1963	178.7	186.4	164.9	191.4	211.4
1964	193.5	194.4	170.8	192.9	221.3
1965	199.0	201.3	179.1	201.0	234.0
1966	216.7	213.4	188.4	215.3	252.1
1967	229.3	218.6	199.4	227.4	270.1
1968	238.7	249.5	213.2	242.1	292.4

Table 9B

	Pulp and paper mills	Printing, publishing & allied industries	Iron and steel mills	Agricultural implements	Motor vehicles	Motor vehicle parts & accessories
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	106.7	106.6	103.1	100.1	113.3	111.5
1951	122.8	115.5	114.0	113.6	117.2	120.7
1952	128.7	125.9	124.6	129.8	128.7	130.6
1953	133.7	136.1	130.1	133.2	140.3	136.4
1954	137.0	141.3	132.2	127.8	133.7	139.9
1955	140.8	149.3	147.7	133.8	141.9	146.2
1956	148.8	155.2	158.5	140.0	150.5	150.4
1957	154.0	163.9	166.6	143.5	152.5	159.2
1958	158.3	172.8	171.6	161.3	173.2	168.0
1959	163.6	181.2	183.6	170.6	181.9	176.8
1960	173.8	188.4	186.4	178.9	191.7	184.0
1961	168.9	194.4	195.4	175.2	192.4	190.5
1962	174.2	200.7	200.4	187.0	211.0	201.4
1963	178.1	206.1	209.5	199.0	224.5	207.4
1964	184.9	210.2	213.7	208.7	223.1	219.0
1965	192.6	221.1	219.5	209.6	239.0	236.7
1966	210.2	233.1	228.3	223.7	248.9	228.5
1967	221.9	247.8	242.2	233.3	255.8	236.9
1968	238.7	263.0	254.2	247.9	294.9	272.8

Table 9B

	Smelting & refining	Electrical products	Cement manufacturers	Petroleum and coal products	Chemicals	All manufacturing
1949	100.0	100.0	100.0	100.0	100.0	100.0
1950	102.7	105.0	106.4	107.1	105.7	105.8
1951	114.9	117.3	116.9	121.8	118.0	117.6
1952	124 2	128.1	126.8	137.6	127.4	127.6
1953	130.8	132.8	134.3	142.3	134.6	134.7
1954	136.8	140.3	137.2	145.2	141.0	138.9
1955	143.5	141.1	141.7	151.5	146.6	144.2
1956	146.8	151.8	146.6	168.9	156.0	152.6
1957	158.1	160.3	160.6	182.7	166.6	160.2
1958	168.9	171.9	169.2	187.8	175.9	168.3
1959	171.8	174.7	176.0	204.7	182.2	175.8
1960	179.7	182.1	181.6	211.2	191.1	181.8
1961	185.5	182.8	193.3	218.0	198.8	182.6
1962	187.7	187.0	202.1	226.8	205.8	193.7
1963	194.1	191.4	207.8	233.0	213.1	201.2
1964	201.2	199.0	213.6	244.2	220.5	209.7
1965	210.5	205.6	229.4	259.1	229.0	220.0
1966	219.2	214.3	240.0	280.9	243.4	233.3
1967	236.4	222.6	248.4	298.2	250.2	247.3
1968	251.4	222.5	269.4	301.9	254.9	266.5

Table 9C

Annual Wages and Annual Wages and Salaries per Worker, 1961 to 1968

	Slaughtering & meat processors		Bakery products		Distilleries		Breweries		Tobacco products	
	1	2	1	2	1	2	1	2	1	2
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	104.6	103.3	106.8	106.6	103.5	103.3	104.5	105.0	99.2	101.3
1963	106.2	105.1	110.3	110.4	108.9	108.3	105.9	108.4	103.1	103.4
1964	111.1	109.3	116.5	115.5	114.1	113.6	110.2	111.6	109.0	108.2
1965	115.6	115.3	121.2	121.1	122.7	122.2	116.8	117.5	117.1	117.4
1966	122.9	121.1	125.6	125.3	126.4	126.1	125.0	127.1	123.4	124.5
1967	132.1	129.9	133.5	132.5	135.4	133.0	128.5	133.5	132.8	134.2
1968	139.9	138.0	144.4	143.4	145.5	141.0	143.1	143.6	147.0	148.8

	Rubber industries		Cotton yarn & cloth mills		Synthetic textile mills		Clothing industries		Furniture & fixtures	
	1	2	1	2	1	2	1	2	1	2
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	105.3	104.3	105.3	104.3	102.8	101.9	106.7	105.3	105.4	104.2
1963	105.8	117.1	109.9	109.1	109.8	106.5	110.0	109.3	108.2	110.7
1964	112.2	124.3	120.2	118.2	115.8	111.1	114.7	113.3	113.7	111.6
1965	117.5	130.1	123.2	121.5	119.4	115.1	120.4	118.7	118.7	116.3
1966	121.7	134.4	133.4	132.3	125.7	122.0	127.3	124.9	126.2	124.6
1967	132.0	146.5	138.7	140.1	129.3	124.9	134.3	132.3	132.4	131.6
1968	141.4	158.2	142.9	145.8	147.0	142.6	145.1	141.4	141.7	140.0

Column 1 — wages
Column 2 — wages and salaries

Source as in 9B

Table 9C

	Saw and planning mills		Pulp and paper mills		Printing, publishing & allied industries		Iron and steel mills		Agricultural implements	
	1	2	1	2	1	2	1	2	1	2
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	106.6	106.2	103.3	103.2	106.5	103.2	102.4	102.5	107.0	106.7
1963	112.6	112.1	105.9	105.5	108.0	106.0	108.0	107.2	114.9	113.6
1964	117.3	117.3	110.3	109.5	112.2	108.1	110.3	109.4	117.5	119.2
1965	124.3	124.0	115.1	114.1	117.8	113.7	113 1	112.3	119.3	119.7
1966	133.5	133 6	126.5	124.5	123.4	119.9	116.0	116.8	127.4	127.7
1967	142.3	143.2	133.0	131.4	128.7	127.5	122.3	123.9	145.3	133.2
1968	154.2	155.0	142.8	141.4	136.1	135.3	128.6	130.0	138.5	141.5

	Motor vehicles		Motor vehicle parts and accessories		Smelting and refining		Electrical products		Cement manufacturers	
	1	2	1	2	1	2	1	2	1	2
1961	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1962	112.6	109.6	107.2	105.8	101.7	101.2	102.8	102.3	103.4	104.6
1963	120.9	116.6	112.1	108.9	103.2	104.6	106.0	104.7	106.0	107.5
1964	117.9	115.9	117.6	115.0	107.6	108.5	110.5	108.9	110.3	110.5
1965	131.4	124.2	127.3	124.3	113.2	113.5	114.3	112.5	121.1	118.7
1966	130.4	129.4	122.6	120.0	117.3	118.2	119.4	117.3	126.4	124.2
1967	135.0	132.9	126.8	124.4	128.9	127.5	123.2	121.8	130.1	128.5
1968	156.4	153.3	147.3	143.2	133.6	135.5	134.3	121.7	140.1	139.4

Column 1 — wages
Column 2 — wages and salaries

Table 9C

	Petroleum and coal products		Chemicals		All manufacturing	
	1	2	1	2	1	2
1961	100.0	100.0	100.0	100.0	100.0	100.0
1962	104.8	104.0	103.4	103.5	104.6	106.1
1963	107.4	106.9	107.0	107.2	108.5	110.2
1964	112.6	112.0	110.6	110.9	113.5	114.8
1965	114.6	118.9	114.0	115.2	119.4	120.5
1966	128.7	128.8	121.1	122.4	126.4	127.7
1967	138.3	136.8	128.9	125.9	133.5	135.4
1968	148.7	138.5	138.2	128.2	143.9	145.9

Column 1 — wages
Column 2 — wages and salaries

Table 10

Relative Increase (1949-1968), Wages Per Worker

	(1)	(2)	(3)
Slaughtering & meat processors	95.6	106.4	103.2
Bakery products	100.6	108.2	105.9
Distilleries	113.8	–	–
Breweries	108.6	103.6	103.9
Tobacco products	114.0	108.4	108.6
Rubber industries	102.4	92.5	87.6
Cotton yarn and cloth mills	85.8	106.4	104.3
Synthetic textile mills	86.6	113.7	100.0
Clothing industries	83.9	103.7	99.8
Furniture and fixtures	92.8	98.1	98.0
Saw and planing mills	105.5	98.5	92.0
Pulp and paper mills	97.2	113.8	108.5
Printing, publishing & allied industries	100.0	102.6	97.4
Iron and steel mills	95.1	110.8	102.7
Agricultural implements	92.3	108.1	111.4
Motor vehicles	115.3	88.3	84.9
Motor vehicle parts & accessories	104.3	–	94.4
Smelting and refining	93.1	105.9	–
Electrical products	87.1	101.0	103.5
Cement manufacturers	99.0	–	–
Petroleum and coal products	119.8	94.2	87.1
Chemicals	103.3	103.6	102.1
All manufacturing	100.0	99.7	96.5

Explanation of columns:

(1) Index of annual wages per worker for the industry, compared with the index for all manufacturing $\frac{(W/L)_j}{(W/L)_{\Sigma j}}$ where the numerator is the index for industry j and the denominator is the index for all manufacturing (not the average for the 22 industries covered by this study).

(2) Index of average hourly earnings, as a proportion (times 100) of the index of annual wages per worker.

(3) Wage rate index as a proportion (times 100) of the index of annual wages per worker.

All these measures are derived from the indexes in Table 9A.

Table 11

Annual Rate of Change*, Compensation per Worker

	Production labour 1949-1968			Total labour 1949-1968			Production labour 1961-1968			Total labour 1961-1968		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	6.9	6.2	.989	6.8	5.9	.989	6.0	2.9	.979	5.9	2.7	.982
Bakery products	7.4	5.9	.991	7.3	5.6	.992	5.7	2.5	.984	5.6	2.4	.986
Distilleries	10.2	6.4	.994	10.1	6.4	.994	6.7	2.0	.992	6.1	1.2	.997
Breweries	8.1	8.0	.987	8.2	7.6	.989	6.2	3.6	.970	6.4	2.9	.982
Tobacco products	8.7	10.3	.981	8.8	10.8	.980	8.1	3.3	.983	8.2	4.2	.975
Rubber industries	7.0	7.2	.987	7.1	10.5	.973	5.9	3.2	.975	7.7	3.0	.988
Cotton yarn and cloth mills	7.0	9.0	.973	7.3	8.8	.977	6.2	1.8	.993	7.0	1.7	.994
Synthetic textile mills	5.0	8.0	.968	6.1	7.0	.984	6.3	3.8	.969	6.1	4.1	.960
Clothing industries	6.0	7.0	.978	5.6	5.9	.983	6.1	2.5	.985	5.7	2.2	.988
Furniture and fixtures	6.7	5.7	.990	6.7	5.5	.991	5.8	2.0	.989	5.7	2.7	.981
Saw and planing mills	8.5	10.2	.978	9.6	10.7	.981	7.5	2.7	.989	7.8	2.9	.988
Pulp and paper mills	6.5	8.6	.978	5.4	7.8	.976	6.7	3.1	.980	6.6	3.3	.977
Printing, publishing & allied industries	7.5	3.5	.997	7.3	4.6	.995	4.8	1.8	.988	5.4	2.7	.978
Iron and steel mills	7.2	4.0	.996	7.4	3.8	.997	3.9	1.7	.984	4.3	2.0	.982
Agricultural implements	7.1	9.1	.978	7.4	6.7	.988	5.5	5.2	.936	5.1	2.1	.987
Motor vehicles	9.5	11.5	.979	9.0	9.7	.984	5.5	6.2	.919	5.9	5.4	.940
Motor vehicle parts and accessories	7.3	8.4	.938	7.4	7.2	.988	5.2	5.7	.914	5.1	5.3	.920
Smelting and refining	6.4	5.6	.990	6.9	5.3	.992	5.7	2.8	.977	5.8	2.5	.982
Electrical products	5.1	4.9	.989	5.6	4.1	.994	4.9	2.3	.980	3.5	1.3	.988
Cement manufacturers	7.4	6.8	.988	8.1	5.7	.993	6.1	2.3	.987	5.6	2.4	.984
Petroleum and coal products	9.4	9.9	.972	9.8	6.7	.994	7.4	4.6	.967	6.3	2.5	.986
Chemicals	7.6	5.3	.994	7.6	2.0	.999	5.6	2.8	.978	4.3	1.3	.993
All manufacturing	7.2	6.7	.988	7.5	6.7	.990	6.3	2.2	.989	6.3	2.5	.987

*percentage rate, computed by least squares of actual values

S — standard error of estimate

R — goodness of fit ratio

Source Tables 9A, 9B

Prices

The indexes of implicit (value-added) price, or of value added per unit of output, are presented in Table 12, there being two series for each industry, one based on value added by manufacturing, covering the period from 1949 to 1968, the other based on value added by total activity, covering the shorter period, 1961 to 1968, because the total activity concept was introduced in 1961. A summary giving 1968 values over 1949 and 1961 appears in Table 13.

Not surprisingly, the indexes show great interindustry variation. Between 1949 and 1968 the index based on value added, manufacturing declined by as much as 31.0 percent for synthetic textiles and rose as much as 104.4 percent for motor vehicle parts and accessories. The increase for all manufacturing was 33.0 percent and ten of the 22 industries showed increases less than this. For 1961 to 1968 the increase was 6.2 percent for all manufacturing, with implicit price changes ranging from a reduction of 17.8 percent to an increase of 45.6 percent, with nine of the 22 industries showing indexes lower than that for all manufacturing. The increase (1968 over 1961) for all manufacturing based on value added by total activity was 10.5 percent, higher than the 6.2 percent based on value added, manufacturing.

Anyone who has read up to this point realizes that the prices examined here are not only an analytical concept (hence the term, "implicit" price) but are rather far removed from the final retail price paid by the ultimate consumer. The retail price reflects the combined effect of production costs and markups from the initial extractive operation (be it mining, logging, fishing, farming, etc.) through various stages of processing, distribution to final sales. The part of the retail price of concern to this study is that part accounted for by the activities of the establishments that make up each of the industries under examination; all of which is explained in some detail in Chapter Three.

It is worthwhile to compare the implicit (value-added) price indexes with some indexes of wholesale and retail price where this is possible.

Our first comparison is with wholesale price. It will be recalled that a wholesale price reflects not only the labour and other costs of production in the establishment (which is, of course, what constitutes the implicit price) but also the costs of raw materials, fuel, energy and other inputs from outside the establishment. The difference between the implicit and wholesale price can be attributed to costs of raw materials, fuel and energy inputs plus possible markup on the f.o.b. plant price. Wholesale price indexes are for commodities, of course, but Statistics Canada has combined groups of these indexes so as to reflect the wholesale price change of the output of industries; these are called industry selling price indexes.[11]

A comparison of the implicit (value-added) price and industry selling price indexes appears in Table 14. For the period, 1961 to 1968, the implicit price indexes can be compared with the ISPI. The latter index was introduced in 1956, so it cannot be used for comparisons back to 1949, the first year for this study. The table does include a comparison of the ISPI with the implicit (value-added, manufacturing) price index for 1956 to 1968; the other implicit price index cannot be used in this comparison because the total activity concept, it will be recalled, was introduced in 1961.

There is no ISPI for all manufacturing as such, so a comparison of price indexes at that level is not possible. Nor is such an index published for clothing, printing, publishing and allied industries, or for electrical products that can be used in the 1961-1968 comparison; nor for the rubber industries, furniture and fixtures, cement manufacturers, petroleum and coal products, and chemicals for the 1956-1968 period; and smelting and refining has also been excluded because of a break in the value added, manufacturing series for that industry between 1960 and 1961, affecting the continuity of the implicit price index. The brief analysis that immediately follows makes use of only the implicit price index based on value added, manufacturing.

For 14 of the 19 industries for which data are available the ISPI increased more than the implicit price index from 1961 to 1968, and for eight of the 14 industries for which a 1956 to 1968 comparison was possible, the ISPI was greater. Where the ISPI is greater than the implicit index it must be due to higher unit costs of raw materials and/or fuel and energy inputs than of unit costs in the manufacturing operation within the establishment; or it must be explained by markups on the price at the plant that cannot be included in value added.

With respect to the 1961-1968 period, for the 14 industries where the ISPI exceeded the implicit price index, the average excess was 7.6 percent, and for the five where the implicit price index exceeded the ISPI, the average excess was 8.9 percent. The industry where the ISPI exceeded the implicit price index the most was motor vehicles where the margin was 23.8 percent, and the industry where the implicit price index exceeded the ISPI the most was motor vehicle parts and accessories where the difference was 17.0 percent.

The fact is that most of the implicit and industry selling price indexes moved closely together. Of the 19 industries for which 1961-1968 comparisons were possible, only in the case of seven of them were the differences between the indexes greater than five percent. (That is, one index measured as a percentage of the other, not a difference in percentage points.) But in five of these, agricultural implements, motor vehicles, motor vehicle parts and accessories, smelting and refining, and petroleum and coal products, the difference was large enough to suggest some important developments in the organization and integration of these industries. With these exceptions, it would seem reasonably safe to say that much of what this study

Table 12

Implicit (Value-Added) Price Indexes[x]

	Slaughtering & meat processors		Bakery products		Distilleries		Breweries	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0		100.0		100.0		100.0	
1950	100.0		102.6		111.8		103.5	
1951	114.9		111.7		111.8		109.8	
1952	125.4		117.7		114.7		106.2	
1953	126.8		117.9		108.0		116.4	
1954	119.7		114.6		118.9		118.4	
1955	124.4		117.1		119.3		119.7	
1956	115.4		115.2		112.1		117.3	
1957	123.6		124.0		120.3		116.2	
1958	123.3		127.8		120.3		120.9	
1959	126.6		128.2		120.6		119.8	
1960	127.2		131.2		126.2		121.1	
1961	115.3	100.0	133.7	100.0	123.8	100.0	123.5	100.0
1962	115.9	100.4	130.9	98.1	120.5	97.2	120.2	98.6
1963	110.3	95.6	136.2	102.3	121.2	97.8	121.3	99.2
1964	110.3	96.3	142.4	107.1	126.4	102.0	125.3	102.6
1965	107.3	94.3	146.0	109.9	127.2	103.0	124.7	102.3
1966	126.4	110.0	156.3	117.5	127.1	102.6	123.8	101.0
1967	126.6	118.6	155.4	116.5	125.5	101.3	125.7	103.4
1968	130.4	112.5	155.7	117.8	129.5	105.1	133.1	108.7

[x] The indexes are of value added divided by the index of production.

Source — as in Table 2

Table 12

	Tobacco products		Rubber industries		Cotton yarn and cloth mills		Synthetic textile mills	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0		100.0		100.0		100.0	
1950	105.7		112.3		97.9		100.6	
1951	105.1		127.2		104.5		95.2	
1952	108.9		136.7		109.0		93.9	
1953	106.3		126.2		98.3		78.5	
1954	106.9		124.7		93.1		79.5	
1955	107.7		132.2		99.7		77.9	
1956	98.9		123.3		110.7		70.5	
1957	90.8		115.5		108.0		74.1	
1958	93.6		113.5		97.2		73.9	
1959	100.0		105.5		100.5		76.0	
1960	98.9		109.9		104.2		76.8	
1961	105.4	100.0	110.8	100.0	103.5	100.0	76.6	100.0
1962	102.9	97.3	90.2	82.4	104.1	100.1	77.4	100.1
1963	103.6	98.5	94.2	87.0	105.9	101.7	81.4	105.7
1964	98.5	94.6	98.2	89.6	101.9	98.7	81.6	105.1
1965	110.0	104.3	105.4	96.3	101.6	98.6	75.0	97.5
1966	113.0	106.8	109.2	100.3	108.1	105.6	73.6	95.4
1967	112.6	116 0	109.7	100.2	113.5	109.8	70.2	92.2
1968	121.7	114.8	111.3	101.9	109.7	105.0	69.0	90.7

Table 12

	Clothing industries		Furniture & fixtures		Saw & planing mills		Pulp & paper mills	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0		100.0		100.0		100.0	
1950	98.8		99.2		112.2		111.7	
1951	104.3		105.8		119.3		139.1	
1952	104.1		109.8		117.1		122.1	
1953	106.0		107.3		113.9		120.5	
1954	102.3		111.6		113.8		123.9	
1955	102.7		110.3		115.7		128.9	
1956	100.8		113.1		112.6		127.7	
1957	105.0		117.5		106.5		124.2	
1958	105.4		122.0		108.1		128.5	
1959	108.5		120.6		106.8		128.2	
1960	109.2		120.0		100.5		129.0	
1961	108.3	100.0	119.4	100.0	99.8	100.0	133.4	100.0
1962	110.6	102.0	120.4	100.3	101.8	101.4	142.8	106.8
1963	111.5	103.0	121.1	101.3	103.0	102.1	142.9	106.9
1964	116.1	107.0	124.9	104.5	100.5	99.0	144.5	108.2
1965	117.9	108.9	123.3	103.2	99.8	98.3	145.4	108.9
1966	127.8	117.9	128.5	107.3	106.7	105.6	145.4	108.7
1967	133.8	124.1	134.1	111.9	110.6	109.8	146.9	109.9
1968	137.3	126.9	134.9	112.5	145.3	140.3	142.4	106.6

Table 12

	Printing, publishing & allied industries		Iron & steel mills		Agricultural implements		Motor vehicles	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0		100.0		100.0		100.0	
1950	98.9		106.4		104.8		121.2	
1951	102.7		121.3		107.2		103.7	
1952	113.5		134.8		125.4		97.4	
1953	117.0		125.5		141.1		90.2	
1954	113.5		146.3		125.4		75.5	
1955	116.9		137.6		139.3		87.7	
1956	117.0		136.2		145.5		90.4	
1957	117.6		152.0		157.1		94.2	
1958	127.7		166.0		131.2		100.3	
1959	125.9		152.8		138.1		131.5	
1960	127.2		150.2		136.2		127.1	
1961	127.4	100.0	151.6	100.0	129.8	100.0	104.4	100.0
1962	131.8	101.4	156.1	102.2	130.5	106.1	124.7	111.8
1963	131.0	100.9	157.0	102.8	121.3	106.0	124.2	110.1
1964	135.0	104.1	155.0	101.5	127.1	103.8	118.4	105.6
1965	138.9	107.2	161.3	105.5	128.5	104.5	111.8	103.6
1966	140.0	107.8	164.0	107.0	134.1	109.6	105.3	98.2
1967	143.4	110.8	170.6	111.2	132.8	108.8	97.6	96.0
1968	148.5	114.4	161.8	105.8	133.0	109.7	85.8	93.5

Table 12

	Motor vehicle parts & accessories		Smelting & refining		Electrical products		Cement Manufacturers	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0				100.0		100.0	
1950	95.4				103.9		105.1	
1951	106.6				108.6		118.5	
1952	115.0				117.9		135.2	
1953	118.9				112.5		137.6	
1954	120.9				113.2		134.7	
1955	118.8				99.7		134.5	
1956	130.8				108.4		130.8	
1957	126.9				115.0		131.1	
1958	129.1				108.3		140.0	
1959	125.3				110.2		143.8	
1960	125.5				106.3		155.3	
1961	162.0	100.0	100.0	100.0	103.2	100.0	167.0	100.0
1962	162.6	100.7	97.8	98.4	102.7	100.0	167.6	100.2
1963	173.2	106.1	92.5	94.0	100.2	97.1	173.6	103.2
1964	178.3	108.8	99.9	101.9	99.5	96.5	174.2	103.2
1965	172.9	106.2	111.4	114.7	98.5	96.3	176.2	104.6
1966	181.6	111.4	106.0	108.3	99.1	97.1	181.3	107.6
1967	195.0	119.7	111.3	112.8	98.2	96.0	192.8	114.3
1968	204.4	125.1	110.3	111.6	100.4	98.0	203.6	120.3

Table 12

	Petroleum and coal products		Chemicals		All manufacturing	
	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity	VA Mfg.	VA Total Activity
1949	100.0		100.0		100.0	
1950	109.4		101.0		104.6	
1951	118.8		107.6		112.5	
1952	136.6		108.0		116.2	
1953	116.8		104.7		116.4	
1954	184.3		102.2		117.8	
1955	186.2		104.7		118.8	
1956	186.5		100.3		119.2	
1957	199.1		100.7		122.2	
1958	190.3		103.9		124.2	
1959	184.1		106.4		122.1	
1960	216.4		110.2		123.5	
1961	209.8	100.0	108.0	100.0	125.2	100.0
1962	188.8	90.4	106.7	98.9	129.0	100.5
1963	176.0	84.6	106.5	99.6	123.8	101.2
1964	175.2	84.5	100.8	94.8	124.6	102.2
1965	154.5	74.9	100.9	94.5	126.1	104.0
1966	155.1	76.0	101.3	95.1	125.9	106.1
1967	162.5	78.6	101.7	94.9	131.0	108.4
1968	175.6	85.3	102.5	95.3	133.0	110.5

Table 13

Changes in Implicit (Value-Added) Price

	Based on value added, manufacturing		Based on value added, total activity
	1968/1949	1968/1961	1968/1961
Slaughtering and meat processors	130.4	113.1	112.5
Bakery products	155.7	116.5	117.8
Distilleries	129.5	104.6	105.1
Breweries	133.1	107.8	108.7
Tobacco products	121.7	115.5	114.8
Rubber industries	111.3	100.5	101.9
Cotton yarn and cloth mills	109.7	106.0	105.0
Synthetic textile mills	69.0	90.1	90.7
Clothing industries	137.3	126.8	126.9
Furniture and fixtures	134.9	113.0	112.5
Saw and planing mills	145.3	145.6	140.3
Pulp and paper mills	142.4	106.7	106.6
Printing, publishing & allied industries	148.5	116.6	114.4
Iron and steel mills	161.8	106.7	105.8
Agricultural implements	133.0	102.5	109.7
Motor vehicles	85.8	82.2	93.5
Motor vehicle parts & accessories	204.4	126.2	125.1
Smelting and refining	—	110.3	111.6
Electrical products	100.4	97.3	98.0
Cement manufacturers	203.6	121.9	120.3
Petroleum and coal products	175.6	83.7	85.3
Chemicals	102.5	94.9	95.3
All manufacturing	133.0	106.2	110.5

Source Table 12

Table 14

Comparison of Implicit (Valued-Added) and Industry Selling Price Indexes

	1968/1961 Implicit price		ISPI	1968/1956 Implicit price	ISPI
	1	2		1	
Slaughtering and meat processors	113.1	112.5	115.2	113.0	131.7
Bakery products	116.5	117.8	119.7	135.2	133.7
Distilleries	104.6	105.1	110.2	115.5	117.4
Breweries	107.8	108.7	109.1	113.5	116.6
Tobacco products	115.5	114.8	119.5	123.1	122.2
Rubber industries	100.5	101.9	97.9	90.3	N.A.
Cotton yarn and cloth mills	106.0	105.0	108.3	99.1	104.9
Synthetic textile mills	90.1	90.7	93.1	97.9	89.4
Clothing industries	126.8	126.9	N.A.	136.2	N.A.
Furniture and fixtures	113.0	112.5	112.2	119.3	N.A.
Saw and planing mills	145.6	140.3	150.0	129.0	139.7
Pulp and paper mills	106.7	106.6	110.1	111.5	112.7
Printing, publishing & allied industries	116.6	114.4	N.A.	126.9	N.A.
Iron and steel mills	106.7	105.8	103.0	118.8	105.4
Agricultural implements	102.5	109.7	114.3	91.4	129.4
Motor vehicles	82.2	93.5	101.8	94.9	118.9
Motor vehicle parts and accessories	126.2	125.1	107.9	156.3	114.4
Smelting and refining	110.3	111.6	133.6	—	127.5
Electrical products	97.3	98.0	N.A.	92.6	N.A.
Cement manufacturers	121.9	120.3	116.3	155.7	N.A.
Petroleum and coal products	83.7	85.3	98.1	94.2	N.A.
Chemicals	94.9	95.3	101.0	102.2	N.A.
All manufacturing	106.2	110.5	N.A.	111.6	N.A.

Sources Implicit (value-added) price — Table 12
Industry selling price indexes — D.B.S.: *Industry Selling Price Indexes, 1956-1968* (Catalogue No. 62-528)

Implicit Price Index 1 — based on VA, manufacturing
2 — based on VA, total activity

says about the behaviour of the cost component of value-added price would not be substantially different if said with respect to wholesale price instead; except, of course, that with respect to the latter price, the relative importance of factor cost at the establishment level is diminished.

In concluding this comparison of the implicit (value-added) price with other prices, we offer some direct comparisons with one of the consumer price sub-indexes that measures change in retail prices. Reflecting 1968 values indexed on 1961, they are as follows:

Table 15

Measures of Price Change Compared

	Implicit price index (VA mfg.)	I.S.P.I.	Consumer price subindex*	
Distilleries	104.6	110.2	123.9	(liquor)
Breweries	107.8	109.1	112.2	(beer)
Tobacco products	115.5	119.5	126.8	(tobacco)
Cotton yarn and cloth mills	106.0	108.3	117.6	(cotton textiles)
Synthetic textile mills	90.1	93.1	109.9	(synthetic textiles)
Clothing industries	126 8	N.A.	121.1	(clothing)
Furniture and fixtures	113.0	112.2	120.3	(furniture-home furnishings)
Motor vehicles	82.2	101.8	96.5	(new passenger car)
Petroleum and coal products	83.7	98.1	95.0	(fuel oil)
			115.3	(gasoline)

*These indexes are obtained from Statistics Canada: *Prices and Price Indexes,* (Catalogue No. 62-002), Table 9

In the case of distilleries, breweries and tobacco products the output of each industry is sufficiently homogeneous that it is safe to assume that each price index is related to the same product but at different stages of its reaching the retail market. We can probably make the same assumption for cotton yarn and cloth mills, synthetic textile mills, and the clothing industries although much of the output of each of these industries is not measured by the consumer price index, something that probably applies even more to furniture and fixtures. In the motor vehicles industry the output consists of trucks and other vehicles as well as some kinds of passenger cars not priced by Statistics Canada for purposes of the consumer price index. Nevertheless, the product or products covered by the C.P.I. constitute a sufficiently large part of total output that a comparison of these indexes seems reasonable. This principle may not apply to the same degree with respect to petroleum and coal products although fuel oil and gasoline are indeed large items in the total output of that industry.

The possible reasons for the difference between the implicit and wholesale (i.e. industry selling) prices have already been suggested. Where the retail price, as illustrated by the consumer price sub-index is higher than one or both of the other indexes, it can be the result of higher costs of retail selling, a higher rate of return (i.e. profit) to retail establishments, increased sales tax, or a combination of the three. It is not within the purview of this report to investigate these questions.

We must reiterate that, except for the brief analysis of wholesale and retail prices just concluded, our concern is only with that part of price behaviour attributable to the establishments making up each industry that is studied. That part of price behaviour is, of course, the implicit (value-added) price. As the preceding demonstrates, even if it does nothing else, conclusions drawn from this study do not apply, *as such,* to the retail prices paid by the consumer. Of course, they have a bearing but how they apply in each case requires additional study.

The annual trend values for implicit price change are shown in Table 16. The first series, based on value added, manufacturing and covering 1949 to 1968, do not show as clear a trend as the second series based on value added, total activity, covering 1961 to 1968. The goodness of fit, as indicated by R, averaged for the 21 industries, is .639 for the first series

Table 16

Annual Rate of Change,* Implicit (Value-Added) Price

	Based on VA manufacturing 1949 to 1968			Based on VA manufacturing 1961 to 1968			Based on VA total activity 1961 to 1968		
	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	0.3	9.0	.242	3.7	7.1	.756	3.7	6.8	.767
Bakery products	2.6	4.1	.967	3.4	2.4	.956	3.5	2.3	.963
Distilleries	0.9	3.0	.884	1.1	1.6	.836	1.1	1.6	.848
Breweries	1.0	3.3	.891	1.4	2.2	.837	1.3	2.0	.855
Tobacco products	0.6	7.7	.393	4.0	4.3	.895	3.8	3.9	.909
Rubber industries	−1.2	9.4	.683	4.1	2.0	.969	4.1	2.1	.967
Cotton yarn and cloth mills	0.4	4.9	.445	1.3	3.3	.681	1.4	3.3	.698
Synthetic textile mills	−1.2	6.5	.682	−2.4	3.7	.856	−2.2	3.4	.850
Clothing industries	1.8	5.6	.867	4.5	2.4	.975	4.6	2.5	.974
Furniture and fixtures	1.5	2.8	.955	2.2	1.6	.955	2.2	1.6	.956
Saw and planing mills	−0.2	10.8	.093	5.8	12.2	.724	5.3	11.1	.725
Pulp and paper mills	1.3	6.0	.830	0.2	1.3	.324	0.2	1.3	.360
Printing, publishing & allied industries	2.2	3.1	.974	1.9	3.8	.766	2.2	1.1	.977
Iron and steel mills	2.1	8.6	.867	1.2	2.6	.761	1.2	2.4	.757
Agricultural implements	0.4	12.0	.235	1.0	2.8	.647	0.8	1.9	.703
Motor vehicles	0.6	16.2	.201	−5.0	3.2	.977	−2.9	0.9	.993
Motor vehicle parts and accessories	5.8	10.1	.952	3.8	3.4	.934	3.7	3.3	.935
Smelting and refining	—	—	—	3.0	4.5	.833	3.1	5.1	.813
Electrical products	−0.7	4.5	.704	−0.4	1.3	.602	−0.3	1.4	.429
Cement manufacturers	4.1	7.6	.960	3.3	2.8	.939	3.2	2.8	.934
Petroleum and coal products	1.5	29.0	.406	−1.7	5.6	.526	−1.5	5.4	.487
Chemicals	−0.1	3.1	.199	−0.7	2.0	.647	−0.7	1.6	.718
All manufacturing	1.0	2.8	.913	0.9	2.1	.705	1.7	0.7	.984

*percentage rate, computed by least squares of actual values

S — standard estimate of error

R — goodness of fit ratio

Source Table 12

and .800 for the second.[12] The difference between the R values for all manufacturing is not as great, .913 for the first series and .984 for the second. As subsequent discussion of other trend values points out, there are reasons for expecting a better fitting trend since 1961 because of the underlying economic expansion that began in that year and continued through to 1968, while the period from 1949 to 1960 displayed marked fluctuations in aggregate economic activity that would interfere with the establishment of longrun trend patterns.

Nevertheless, a number of industries show a highly significant trend for the 1949-1968 period. Industries with an R value of .9 or over certainly fall into this group; it means that at least 81 percent of their implicit price change can be associated with the passage of the years. As can be seen from Table 16, these industries are: bakeries, furniture and fixtures, printing, publishing and allied industries, motor vehicle parts and accessories, and cement manufacturers, and all manufacturing itself. All of these show upward implicit price trends and, except for furniture and fixtures, all rather high annual rates. Those with R values of at least .8 but less than .9 can also be regarded as showing a significant trend, with at least 64 percent of implicit price change associated with time. These industries are: distilleries, breweries, clothing, pulp and paper, and iron and steel mills. As with the previous group, they all show a rising trend but, except for iron and steel mills, the annual rates of increase are closer to the all-manufacturing rate.

A negative annual trend rate for 1949-1968 is shown for five industries, rubber, synthetic textiles, saw and planing mills, electrical products and chemicals, but the rates are not of great statistical significance, as can be seen from the R values in the table. Because of the serious break in data on value added for smelting and refining, a trend rate for 1949-1968 for implicit price was not computed for the industry.

It is not entirely accurate to compare 1949-1968 with 1961-1968 trends from the two series in Table 16 because each is based on a different measure of value added. However, from Table 13 it can be calculated that there is an average difference of only .3 percent between 1968 indexes (on base 1961) computed the alternative ways. In only three industries is the difference more than two percent, and they are (showing the percentage by which the index based on value added, total activity differs from that based on value added, manufacturing):

saw and planing mills	– 3.6 percent
agricultural implements	+ 7.0 "
motor vehicles	+13.7 "

When these are eliminated, the average difference for the remaining industries is only .1 percent. Therefore, it is reasonable to compare the two series of trend values in Table 16, although with caution when it concerns the three industries named above.

In the following twelve industries the rate of price change for 1961 to 1968 moved downward from the rate for the longer 1949-1968 period:

slaughtering and meat processors
distilleries
breweries
synthetic textile mills
pulp and paper mills
printing, publishing and allied industries
iron and steel mills
motor vehicles
motor vehicle parts and accessories
cement manufacturers
petroleum and coal products
chemicals.

The difference was too small to be significant for distilleries and breweries. For synthetic textiles it meant a more rapid rate of price decrease and for motor vehicles and petroleum and coal products it meant a reversal from a rate of increase to a rate of decrease. For reasons given above, the difference for motor vehicles and motor vehicle parts and accessories must be considered with caution. For motor vehicles an examination of Table 12 suggests that if the annual rate of change in implicit price for 1961-1968 in Table 16 were based on value added, manufacturing rather than value added, total activity, the reversal from a rate of increase to a rate of decrease would be even greater. On the other hand, for motor vehicle parts and accessories what appears to be a reduced rate of price increase might turn out to be no change. (Between 1961 and 1968 the implicit price for that industry, based on value added, total activity increased 25.1 percent but, based on value added, manufacturing, it increased 26.2 percent.) For chemicals it was a shift from no change to a rate of decline.

For the other nine industries there was an upward movement in the rate of implicit price change:

bakery products
tobacco products
rubber industries

cotton yarn and cloth mills
clothing industries
furniture and fixtures
saw and planing mills
agricultural implements
electrical products.

For the rubber industries there was an apparent reversal from a rate of decrease to a rate of increase, for electrical products it was a slight slowing down in the rate of decrease, and for saw and planing mills it meant a shift from no price change at all to a rate of increase. (For this last industry it can easily be inferred from Table 12 because the index shows that value added by manufacturing increased 45.3 percent between 1949 and 1968 and 45.6 percent between 1961 and 1968, indicating that all the net price increase took place in the latter period.)

Computed trend values (i.e. annual rates of change as calculated by least squares) along with index numbers appear for the first time at this point in the study. The uses and pitfalls of such analysis are discussed at greater lengths in the following chapters where trend values are examined for various purposes, but a few preliminary words are in order at this point.

The comparison of one specific year with another by the use of index numbers is always open to the charge that the years compared are not typical, that the use of other years will either reduce or magnify the differences. Therefore, a computed trend rate based on all the actual year-to-year changes for the period covered is expected to indicate more accurately the averge annual rate of change than can be obtained by comparing one particular year to another.

However, trend values mean something only if there is a discernible trend. The simplest trend is straight-line or linear, and if it has a high degree of statistical significance, the actual values for each year can be expected to approximate closely the computed trend values. The trend may be nonlinear; for example, the growth rate may be speeding up or slowing down, which means the trends follow an exponential curve. In such a situation the actual values will not fit too closely the calculated trend rate based on a simple linear trend, so there will be a low value. Another type of nonlinear trend is cyclical, which means a linear trend value will show a poor fit.

Footnotes

[1]The distinction between production, or real output, and value added is made in Chapter Four and needs no repetition here.

[2]Such a study was published by the Economic Council of Canada towards the end of 1971; Harry H. Postner: *Canadian Manufacturing Productivity - Some Preliminary Results* (Staff Study No. 31). While the author of this study was aware of the Postner project, the two studies were prepared entirely independently of each other.

[3]D.B.S.: *Manufacturing Industries of Canada*, 1964, pages 8-9.

[4]Statistics Canada: *Employment and Average Weekly Wages and Salaries* (Catalogue No. 72-002). All the indexes given in the paragraph are based on this report and not on our Table 3. However, that table shows an almost identical increase in total employment, namely 32.8 percent.

[5]Where L_w is employment in terms of number of workers and L_h is employment in terms of number of man-hours paid for:

$$\frac{Y/L_w}{Y/L_h} = \frac{Y}{L_w} \times \frac{L_h}{Y} = \frac{L_h}{L_w}$$

[6]See pages 10 and 25.

[7]See D.B.S.: *Man-hours and Hourly Earnings*, (Catalogue No. 72-003); beginning in March 1971, this was replaced by *Employment, Earnings and Hours* (Catalogue No. 72-002), but the data used for this study were obtained from the earlier version of this report. One difference between the data for total payroll in these reports and those used in our study is that the monthly averages of the earnings data are obtained from a survey of all firms having 20 or more employees in any month of the year (including establishments in the firm with less than 20 employees), while the payrolls data are for all establishments in all firms, regardless of size. Because the wages may be somewhat lower in the very smallest (excluded) establishments, the hourly wages reported may be a little higher than they would if they were based on the same coverage as that of the Census of Manufactures.

[8]Canada Department of Labour: *Wage Rates, Salaries and Hours of Labour*, an annual publication. The index is part of this report that contains considerable data on straight-time hourly (sometimes weekly) pay for selected occupations in manufacturing and other industries. Indexes of wage rate changes are presented for each industry based on changes from year to year in straight-time pay for selected occupations typical of each industry. The occupational wage rate data have been collected for October first of each year from substantially all establishments having twenty or more employees in any month of the year.

[9]While some research of this kind may be undertaken by the Canada Department of Labour, others who plan to do so are invited to get in touch with the department for further information used in this study if they should need it.

[10]Canada Department of Labour: *Hours of Work in Canada, An Historical Series*, February 1971.

[11]See D.B.S.: *Industry Selling Price Indexes, 1956-1968* (Catalogue No. 62-528).

[12]When the R values are squared, so that $(.639)^2$ equals .408 and $(.800)^2$ equals .640, it means that 40.8 percent of the change in implicit (value-added) price between 1949 and 1968 can be associated with (it might be said, explained by) time as measured in years, and 64.0 percent for the second series.

CHAPTER SEVEN

Labour Productivity - A First Look[1]

The indexes of output per worker, derived from Tables 2 and 3, appear in Table 17. These indexes are drawn from matrixes produced by computer showing the values for each year on an advancing base; thus, the indexes in Table 17 are on a 1949 base (except for the third column for each industry which is on a 1961 base), but the values are available from the matrixes for the years since 1950 on a 1950 base, similarly, for the years since 1951 on a 1951 base, and so on.[2] Indexes of output per worker on a 1961 base are included in the table because many other series presented in this report start from that year; indexes of unit residual cost are based on weights related to value added by total activity which were not available before 1961. Furthermore 1961-1968 should be considered separately partly because it is the more recent period and partly because it was a time of almost steady economic expansion.

The indexes in Table 17 and computations derived from them are the subject of this chapter. Two characteristics of these data can be pointed out at once: the first is the great variation from industry to industry in the change in labour productivity; the second is the volatile nature of these changes, for any industry, over time.

The average for the 21 industries (excluding smelting and refining) for 1968 (over 1949) with respect to production labour is 242.3, the standard deviation is 74.7 and the coefficient of variation, 30.8 percent. That is, the values for individual industries deviated from the mean for the 21 industries by an average of 30.8 percent. With respect to total labour, the average is 223.8, the standard deviation, 67.6, and the coefficient of variation about the same, at 30.2 percent. The indexes for production labour range from a high of 471.2 for petroleum and coal products to a low of 130.3 for pulp and paper mills. The high and low industries were the same for total labour but the indexes were neither as high nor as low as for production labour. Expressing the industry indexes as indexes in turn of the all-manufacturing average reveals the relative performance of each industry, at least in 1968 compared with 1949.[3] These relative indexes appear in Table 18.

The all-manufacturing indexes in Table 17 indicate a somewhat greater increase in output per worker for production labour only, 112.7 percent, than for total labour, of 103.7 percent. The difference is greater, on the average, for the 21 industries, 138.6 percent for production labour and 115.5 percent for total labour. The latter group includes production labour but also takes in the various kinds of salaried employees described in Chapter Four. Obviously, whatever differences there are between measures based on production labour only and on total labour would be even greater if production labour were not included in total labour.

The second characteristic, pointed out above, is the volatility of the year-to-year changes. There might be a sizable increase between two years and just as large a decrease over the next two. These apparent vagaries are best observed from the charts appearing in Chapter Ten. In slaughtering and meat processors, for example, output per worker (production labour only) increased only 4.8 percent for the five years from 1955 to 1960, but increased 45.7 percent for the next five years, from 1960 to 1965, and then declined 3.4 percent over the following three years form 1965 to 1968. These fluctuations underscore the value of using as long a time period as 1949 to 1968 as the basis of analysis so that short-term movements can be distinguished from longrun, underlying trends.

From Table 17 it can be seen that the highest labour productivity index is usually for 1968, the terminal year of the series. This is to be expected because, notwithstanding short-term fluctuations, every industry showed a basic longrun rate of productivity increase, meaning that the final year shown is likely to have the highest index.

The rates of annual change, computed by least squares, are given in Table 19. Each rate is accompanied by its standard error of estimate and goodness of fit ratio (the latter being a coefficient of correlation applied to time series.)[4] For a better understanding of how labour productivity is really behaving, the reader should rely chiefly on the data in this table rather than on comparisons of 1968 with 1949 or 1961 although such comparisons are useful for some purposes. The "strength" of the trend is indicated by the S and R values. The standard error indicates the amount of fluctuation, in percentage points, around the trend, and the higher the value for S the less pronounced the annual trend.[5]

Having in mind the volatility of these series, it is to be expected that they will have rather large standard errors. They are large compared with what is likely to be found in the physical sciences where the behaviour of natural phenomena is usually less erratic than social or semi-social, semi-physical phenomena like productivity.

Table 17

Indexes of Ouput per Worker

	Slaughtering and meat processors			Bakery products			Distilleries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	100.4	99.9		105.3	105.8		104.1	105.1	
1951	96.0	95.5		108.8	109.3		109.6	112.5	
1952	104.0	105.4		111.9	112.8		107.3	110.6	
1953	98.7	99.7		115.0	116.3		114.5	119.6	
1954	109.8	109.0		116.6	117.5		113.3	116.9	
1955	115.4	115.5		117.1	118.2		115.4	120.0	
1956	114.8	114 7		119.7	120.8		125.6	132.4	
1957	112.2	111.5		119.6	120.2		129.7	134.3	
1958	118.3	117.8		122.7	124.1		146.0	148.6	
1959	122.6	124.7		125.6	126.7		165.2	164.1	
1960	120.8	121.7		124.4	125.3		178.2	172.9	
1961	129.6	130.4	100.0	130.7	132.8	100.0	198.9	180.9	100.0
1962	143.7	143.6	110.1	141.7	141.0	106.2	221.7	194.9	107.7
1963	152.4	154.2	118.3	138.8	139.2	104.8	261.0	222.7	123.2
1964	164.4	165.1	126.7	141.4	141.4	106.4	274.9	235.8	130.4
1965	176.0	176.0	135.0	144.4	143.9	108.4	279.5	239.4	132.1
1966	164.1	162.9	124.9	135.4	137.9	103.9	303.2	260.7	144.1
1967	163.9	169.0	129.7	141.8	145.3	109.4	324.7	272.4	150.6
1968	170.0	174.7	134.0	152.2	156.8	118.0	347.6	279.8	154.7

Sources Tables 2 and 3

Table 17

	Breweries			Tobacco products			Rubber industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	103.5	103.4		107.3	106.1		110.8	111.5	
1951	106.5	102.8		106.0	104.3		113.0	111.9	
1952	125.5	123.5		130.3	127.9		115.9	112.2	
1953	130.5	127.4		135.5	135.6		127.3	123.3	
1954	126.4	123.8		142.1	143.2		119.4	116.5	
1955	139.1	133.8		156.1	157.6		133.8	131.5	
1956	141.0	133.2		167.8	169.4		144.9	141.7	
1957	155.1	147.2		178.4	179.1		144.5	140.3	
1958	156.8	148.1		187.2	186.8		165.5	157.3	
1959	173.2	161.5		200.5	198.2		179.4	172.2	
1960	185.0	168.9		230.6	223.8		161.0	154.3	
1961	196.4	178.6	100.0	248.8	240.3	100.0	167.2	147.1	100.0
1962	221.4	196.6	110.0	235.6	227.4	94.6	199.3	204.7	139.2
1963	232.3	204.2	114.3	243.9	242.9	101.1	191.0	197.7	134.3
1964	242.2	205.3	115.0	272.0	262.9	109.4	197.5	201.9	137.3
1965	242.6	202.7	113.5	296.1	290.8	121.0	201.5	204.5	139.0
1966	265.1	222.4	124.5	311.6	305.9	127.3	207.8	214.6	145.8
1967	271.5	230.9	129.3	306.2	291.8	121.5	237.5	239.5	162.8
1968	277.8	231.4	129.6	301.2	283.8	118.1	259.9	255.9	173.9

Table 17

	Cotton yarn and cloth mills			Synthetic textile mills			Clothing industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	109.4	109.3		111.9	108.2		102.4	101.9	
1951	101.6	101.9		129.0	125.2		100.9	100.5	
1952	98.5	95.5		145.6	135.5		108.4	109.1	
1953	100.7	97.4		150.7	141.5		107.7	108.6	
1954	121.1	115.8		161.9	143.3		107.3	110.8	
1955	117.4	109.0		178.9	159.3		115.0	116.2	
1956	117.3	108.9		180.5	160.0		121.7	123.1	
1957	124.6	115.2		192.2	167.9		120.7	121.9	
1958	141.4	127.5		206.1	181.5		125.5	127.0	
1959	153.5	138.6		240.1	209.6		126.4	127.6	
1960	164.5	149.6		247.9	219.9		127.5	128.9	
1961	175.4	161.1	100.0	251.9	227.1	100.0	129.9	132.6	100.0
1962	184.4	168.7	104 8	268.2	243.5	107.2	135.1	140.4	105.9
1963	200.0	183.2	113.8	281.1	256.5	113.0	138.9	147.2	110.0
1964	214.9	198.2	123.0	289.3	266.5	117.3	137.5	146.9	110.8
1965	218.0	201.9	125.4	279.2	255.5	112.5	141.4	150.7	113.7
1966	215.9	195.2	121.2	288.8	260.1	114.5	140.7	151.1	114.0
1967	202.9	185.1	114.9	307.8	280.8	123.7	139.2	150.4	113.5
1968	228.1	204.4	127.0	365.1	327.6	144.2	145.9	158.4	119.5

Table 17

	Furniture and fixtures			Saw and planing mills			Pulp and paper mills		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	106.0	105.7		103.5	104.1		108.1	107.4	
1951	109.5	107.4		103.8	104.6		107.9	107.1	
1952	115.1	112.0		107.6	106.5		102.4	101.7	
1953	116.5	114.0		114.6	112.9		105.5	105.1	
1954	118.9	115.8		120.5	118.1		104.6	104.5	
1955	127.5	123.6		127.6	126.5		105.8	105.7	
1956	130.3	125.6		128.3	128.2		108.2	107.4	
1957	130.8	125.8		132.0	130.2		106.0	104.0	
1958	134.0	128.8		142.9	140.0		107.7	104.9	
1959	140.9	135.2		145.9	146.3		115.1	112.1	
1960	144.5	137.3		156.1	156.2		122.3	117.7	
1961	155.7	148.9	100.0	163.7	166.3	100.0	122.0	117.8	100.0
1962	161.5	155.2	104.3	181.8	190.9	114.8	118.6	113.7	96.6
1963	165.4	159.0	106.8	195.8	203.8	122.6	122.6	117.3	99.6
1964	168.1	162.0	108.9	208.0	221.6	133.2	127.2	122.1	103.7
1965	179.0	173.4	116.4	212.0	227.4	136.8	126.6	121.2	102.9
1966	184.7	181.1	121.6	209.6	226.1	136.0	128.6	122.7	104.2
1967	188.3	183.9	123.6	214.4	232.2	139.6	120.9	115.3	97.9
1968	197.7	191.9	128.9	209.8	227.1	136.6	130.3	123.1	104.6

Table 17

	Printing, publishing and allied industries			Iron and steel mills			Agricultural implements		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	108.6	107.8		108.2	106.8		86.7	84.2	
1951	108.6	108.6		112.1	110.4		84.5	82.4	
1952	108.5	108.1		107.5	105.7		88.7	86.8	
1953	117.7	116.0		107.8	105.6		89.2	82.8	
1954	122.9	121.1		115.9	110.0		76.7	69.6	
1955	128.0	125.2		145.0	139.4		76.3	69.6	
1956	142.9	133.8		158.5	153.4		85.0	75.2	
1957	144.5	134.8		141.6	134.7		83.6	75.4	
1958	141.2	135.2		144.2	133.2		96.5	87.7	
1959	151.7	144.2		167.9	157.6		93.6	87.1	
1960	155.0	144.9		158.0	145.7		99.2	85.6	
1961	164.8	151.0	100.0	179.1	165.4	100.0	114.0	91.1	100.0
1962	170.3	153.2	101.5	184.1	171.0	103.4	114.4	96.9	106.5
1963	174.1	156.1	103.4	198.4	182.5	110.4	141.1	125.4	137.6
1964	182.2	160.7	106.4	207.2	191.2	115.6	158.5	139.8	153.5
1965	190.6	165.0	109.3	213.4	198.3	119.9	157.4	139.8	153.6
1966	200.7	171.7	113.7	202.0	188.4	113.9	156.6	140.7	154.5
1967	202.0	175.9	116.5	194.6	179.4	108.5	169.8	138.3	151.9
1968	204.5	179.5	118.9	226.1	207.8	125.7	170.5	145.4	159.7

Table 17

	Motor vehicles			Motor vehicle parts and accessories			Smelting and refining		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	119.8	118.7		118.5	118.8		103.2	101.6	
1951	127.5	127.2		114.7	114.1		97.8	95.6	
1952	131.9	130.8		113.4	111.8		91.2	89.0	
1953	136 6	136.4		114.0	112.1		98.3	96.1	
1954	131.5	124.0		117.9	111.4		95.3	93.6	
1955	142.4	136 4		128.0	121.3		95.6	93.8	
1956	147.5	139.4		127.9	121.2		93.8	90.6	
1957	145.6	134.2		132.5	122.6		96.6	92.3	
1958	160.2	142.2		138.1	125.6		104.8	97.5	
1959	153.1	140.2		153.2	141.0		107.4	101.6	
1960	159.2	142.8		160.1	144.6		118.4	112.6	
1961	192.3	175.3	100.0	113.3	101.5	100.0	120.2	112.9	100.0
1962	196.7	185.4	105.8	126.9	116.1	114.4	133.2	122.9	108.9
1963	215.5	206.6	117.9	130.5	120.6	118.9	140.4	126.9	112.4
1964	200.7	195.6	111.6	121.8	114.4	112.8	142.6	131.4	116.5
1965	226.9	221.9	126.6	134.8	126.0	124.1	141.6	129.7	114.9
1966	237.2	235.0	134.1	136.8	127.5	125.6	150.9	133.5	118.3
1967	320.5	316.1	180.3	135.5	126.2	124.4	145.6	130.8	115.9
1968	371.4	365.6	208.5	145.3	135.6	133.6	160.0	141.0	124.9

Table 17

	Electrical products			Cement manufacturers			Petroleum and Coal products		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	105.5	104.5		100.4	100.5		115.1	107.4	
1951	102.9	99.9		94.6	94.9		130.6	119.8	
1952	107.0	100.7		88.6	88.0		133.3	120.7	
1953	117.5	109.8		100.3	100.3		143.7	130.6	
1954	127.8	113.0		96.6	93.4		154.3	136.7	
1955	145.4	128.3		99.9	95.9		182.8	158.3	
1956	148.6	132.6		103.5	97.1		211.2	183.2	
1957	144.9	126.0		116.6	109.0		221.1	186.5	
1958	158.3	133.9		123.4	111.3		234.9	191.9	
1959	166.0	144.3		124.3	109.8		273.5	218.5	
1960	181.5	154.8		121.7	106.3		286.7	227.6	
1961	190.9	163.3	100.0	136.7	120.8	100.0	306.9	246.4	100.0
1962	203.8	180.5	110.6	144.9	128.5	106.4	345.8	278.2	112.9
1963	211.1	187.8	115.1	152.9	134.4	111.3	383.7	311.6	126.5
1964	226.4	203.2	124.4	167.1	144.4	119.5	394.2	317.5	128.8
1965	230.8	209.4	128.5	170.7	145.9	120.8	434.4	357.7	145.2
1966	235.8	216.6	132.7	166.2	143.2	118.5	450.4	368.0	149.3
1967	237.7	220.5	135.1	150.0	124.4	103.0	454.9	368.5	149.5
1968	252.3	228.4	139.9	160.6	133.0	110.1	471.2	384.9	156.2

Table 17

	Chemicals			All manufacturing		
	Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0	
1950	108.7	108.5		106.2	105.4	
1951	110.6	112.0		108.7	107.7	
1952	114.4	115.2		111.2	109.2	
1953	121.7	122.2		116.0	113.6	
1954	128.9	129.4		120.8	116.2	
1955	141.4	139.6		129.7	124.6	
1956	155.1	150.5		136.3	130.7	
1957	165.5	157.4		136.9	129.9	
1958	175.5	168.1		143.0	134.2	
1959	182.3	172.5		151.1	142.6	
1960	189.3	178.7		156.4	146.4	
1961	208.8	196.5	100.0	158.1	164.2	100.0
1962	227.9	212.8	108.3	171.4	162.9	99.2
1963	234 6	219.4	111.6	177.4	169.3	103.1
1964	261.7	246.0	125.1	184.6	177.4	108.1
1965	272.8	256.4	130.5	190.6	183.6	111.8
1966	280.1	270.8	137.8	194.2	187.6	114.3
1967	288.6	287.8	146.4	199.6	191.4	116.6
1968	301.3	304.1	154.8	212.7	203.7	124.1

Table 18

Output per Worker, 1968/1949, in Each Industry
Relative to the Index for All Manufacturing

	Based on	
	Production Labour	Total Labour
Slaughtering and meat processors	79.9	85.8
Bakery products	71.6	77.0
Distilleries	163.4	137.4
Breweries	130.6	113.6
Tobacco products	141.6	139.3
Rubber industries	122.2	125.6
Cotton yarn and cloth mills	107.2	100.3
Synthetic textile mills	171.7	160.8
Clothing industries	68.6	77.8
Furniture and fixtures	92.9	94.2
Saw and planing mills	98.6	111.5
Pulp and paper mills	61.3	60.4
Printing, publishing and allied industries	96.1	88.1
Iron and steel mills	106.3	102.0
Agricultural implements	80.2	71.4
Motor vehicles	174.6	179.5
Motor vehicle parts and accessories	68.3	66.6
Smelting and refining	75.2	69.2
Electrical products	118.6	112.1
Cement manufacturers	75.5	65.3
Petroleum and coal products	221.5	189.0
Chemicals	141.7	149.3

Source Table 17

Table 19

Annual Rate of Change*, Ouput per Worker

	Production labour 1949-1968			Total labour 1949-1968			Production labour 1961-1968			Total labour 1961-1968		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	5.2	8.3	.953	5.3	8.2	.957	2.4	6.2	.727	2.9	5.7	.807
Bakery products	2.2	3.7	.967	2.3	3.4	.972	0.8	3.8	.467	1.4	3.8	.685
Distilleries	23.0	23.9	.960	12.8	14.0	.974	8.2	4.1	.983	6.7	3.5	.981
Breweries	11.1	9.4	.987	7.7	6.5	.989	4.3	2.2	.981	3.2	3.2	.932
Tobacco products	12.4	10.4	.989	11.4	10.8	.987	5.2	5.8	.901	4.6	7.3	.832
Rubber industries	7.5	11.2	.967	8.1	13.3	.959	5.5	8.3	.866	4.7	8.1	.871
Cotton yarn and cloth mills	9.2	11.8	.968	8.0	12.3	.954	2.5	6.1	.736	2.2	6.5	.658
Synthetic textile mills	10.6	12.5	.984	10.3	11.5	.984	4.6	8.0	.818	4.4	7.7	.817
Clothing industries	2.4	2.9	.981	3.2	2.7	.990	0.9	1.6	.825	1.6	1.8	.915
Furniture and fixtures	5.0	4.1	.990	4.9	5.2	.983	3.8	1.4	.988	4.2	1.6	.988
Saw and planing mills	7.8	8.5	.979	9.6	11.6	.973	2.2	4.5	.814	3.0	5.1	.863
Pulp and paper mills	1.5	4.1	.904	1.1	3.7	.869	0.9	3.1	.590	0.8	3.1	.497
Printing, publishing & allied industries	5.7	3.9	.993	3.9	2.3	.996	3.7	1.9	.978	3.1	0.6	.990
Iron and steel mills	6.7	10.9	.963	5.8	10.7	.953	2.1	6.3	.642	2.1	6.2	.638
Agricultural implements	8.7	14.9	.906	6.7	14.8	.853	6.2	8.6	.886	5.4	12.3	.792
Motor vehicles	11.6	33.6	.874	11.9	36.7	.850	16.2	17.3	.889	17.7	17.8	.907
Motor vehicle parts and accessories	1.0	11.8	.518	0.6	10.1	.385	2.3	4.2	.815	2.6	3.8	.874
Smelting and refining	4.6	8.9	.926	3.3	7.6	.907	2.6	3.4	.894	1.8	2.6	.878
Electrical products	9.3	5.9	.993	9.0	8.7	.982	3.5	2.0	.975	4.4	2.0	.984
Cement manufacturers	5.5	9.5	.944	3.4	8.9	.890	0.9	7.4	.316	−0.2	7.5	.072
Petroleum and coal products	25.6	16.4	.991	20.4	15.8	.987	5.7	3.7	.972	6.0	4.7	.961
Chemicals	12.9	8.9	.991	12.4	11.5	.984	5.4	2.7	.981	7.4	1.9	.994
All manufacturing	5.9	3.5	.995	5.8	4.6	.990	3.7	1.5	.987	3.9	1.3	.989

*percentage rate, computed by least squares of actual values

S — standard error of estimate

R — goodness of fit ratio

Source Table 17

However, the best indicator is the goodness of fit ratio because while there is no limit to the possible size of the standard error, the R value cannot exceed 1.0, which means a perfect fit. Thus, the closer R is to 1.0 the closer the actual values can be expected to approximate the computed values.

A value for R of .900 and over means that at least 81 percent (which is R^2) of change can be associated with time. The rates based on production labour show R values of .900 or more in 20 of the 22 industries, and also for all manufacturing, while there is one industry, motor vehicles with R only slightly less than .900. For this 1949-1968 production-worker series only one trend rate has an unacceptable R value, being motor vehicle parts and accessories, with .518. This does not mean that the trend rate for that industry has no significance, but that very little change in the values can be related to the passage of time, at least in terms of a linear trend - on which there is further discussion later.

With respect to total labour (1949-1968), the R is .900 or more for 17 of the industries and for all manufacturing; for motor vehicle parts and accessories R is only .385, and there are four other industries where R is less than .900, namely pulp and paper mills with .869, agricultural implements with .853, motor vehicles with .850, and cement manufacturers with .890. For the 1961-1968 trend values based on total labour, R is .900 or more for only nine industries and for all manufacturing, it is between .800 and .900 for seven industries, and is less than that for the other six industries, namely:

bakery products, with .685
cotton yarn and cloth mills, with .658
pulp and paper mills, with .497
iron and steel mills, with .638
agricultural implements, with .792
cement manufacturers, with .072.

It is to be expected that trend values will be less statistically significant the shorter the time period, which would explain the difference between the 1949-1968 and 1961-1968 series. However, in spite of this, the R values for all manufacturing for the three series are very close, being .995, .990 and .989 respectively.

Where a poor fit is indicated, it may mean that a linear trend value - and the values shown in Table 19 and similar tables to follow are all linear - is inappropriate. Some kind of nonlinear trend may be in effect, such as a decreasing rate of change where the rising curve flattens out; or there may be a cyclical pattern.[6] Of course, there is also the possibility that the year-to-year changes are so erratic there is no trend.

The remarkable variation among industries in the performance of labour productivity stands out in Table 19. For production workers (1949 to 1968) it ranges from a high of 25.6 percent increase per annum for petroleum and coal products to a low of 1.0 percent for motor vehicle parts and accessories; if that industry's rate is set aside because of the low R value, the next lowest is pulp and paper mills, with 1.5 percent. For total labour (1949-1968) there are the same high and low industries, petroleum and coal products, with a rate of 20.4 percent, and pulp and paper mills, with 1.1 percent. (Motor vehicle parts and accessories is again left out because of the very low R value.)

The average annual rate of productivity increase for production labour only (1949-1968) for the 21 industries[7] is 8.8 percent. While this is greater than the all-manufacturing rate of 5.9 percent, it must be borne in mind that it is an unweighted average of the 21 separate figures while the 5.9 percent is in effect a weighted average because it is based on the combined, aggregate activity of all manufacturing industries. The 21-industry average reflects the influence of some of the high productivity industries more than their contribution to total manufacturing output would warrant.

Associated with the 21-industry average rate of increase of 8.8 percent is a standard deviation of 6.3 percent and a coefficient of variation (the standard deviation as a percentage of the mean) of 71.1 percent. For total labour for the 1949-1968 period the average rate for the 21 industries is 7.6 percent, somewhat less than the 8.8 percent for production labour only, the standard deviation is 4.7 percent, the coefficient of variation, 62.6 percent, also somewhat less than for production labour. As with the rate for production labour, it is greater than the 5.8 percent for all manufacturing.

The slower increase in the productivity of total labour compared with production labour taken separately follows from the fact, as shown in Chapter Six, that the production labour force did not increase as much as the total labour force. It will be recalled that over the 20 years production-worker employment in all manufacturing increased 27.2 percent while total employment increased 32.8 percent, resulting in an increase in the relative employment of nonproduction labour compared with production labour.

For the 1961-1968 period the average annual rate of increase for the 22 industries (smelting and refining being added in) is 4.1 percent for production labour, the standard deviation 3.4 percent, the coefficient of variation 82.9 percent and for total labour, also 4.1 percent, the standard deviation 3.6 percent, and the coefficient of variation 87.8 percent. The coefficients of variation for 1961-1968 are higher than for the full 1949-1968 period. It seems that the years since 1961 have exhibited greater interindustry variation than was evident in the preceding decade of the 1950's.

A most important observation to be drawn from these data is the notably smaller rate of annual increase in labour productivity, 3.7 percent for production labour for 1961-1968 for all manufacturing, compared with 5.9 percent for 1949-1968, and 3.9 percent for total labour, 1961-1968, compared with 5.8 percent for 1949-1968. Because this calls for fuller investigation, Table 20 contains comparative indexes of labour productivity for both production and total labour for 1968 over 1949 and 1968 over 1961. Of course, some differences can be expected simply because 1949 to 1961 covers 12 years and 1961 to 1968 covers only seven. Bearing this in mind, we can see that there is no significant difference between the increase of production-worker productivity for all manufacturing, an increase of 58.1 percent for 1949 to 1961, compared with 34.6 percent for 1961 to 1968. But based on total labour, the difference is quite notable, 64.2 percent compared with 24.1 percent.

The reader will observe marked contrasts for some industries. Based on production labour only, breweries showed a 96.4 percent increase for 1949 to 1961 and 41.4 percent for 1961 to 1968; for tobacco products it was 148.4 percent compared with 21.1 percent, for synthetic textiles, 151.9 percent and 44.9 percent, for iron and steel mills, 79.1 percent and 26.2 percent, for electrical products, 90.9 percent and 32.2 percent, for petroleum and coal products, 206.9 percent and 53.5 percent, and for chemicals, 108.8 percent and 44.3 percent. Similar contrasts can be observed from the data based on total labour. In the case of agricultural implements there is an opposite constrast, production labour productivity increasing 14.0 percent for the first period and 49.6 percent in the second; also for motor vehicle parts and accessories with figures of 13.3 percent and 28.3 percent, and smelting and refining with 20.2 percent and 33.1 percent.

The difference in the economic climate of these two periods might be sufficient to explain most of the contrasting behaviour. Or circumstances peculiar to each industry might also be significant. That calls for consideration in another study.

An industry-by-industry analysis is part of Chapter Ten but one point must be made here. The low annual rate of productivity increase in pulp and paper mills (1.5 percent for 1949-1968 and 0.8 percent for total labour, 1961-1968) may merely result from the fact that productivity was at a very high absolute level at the beginning of the period so that substantial improvements in output per worker in absolute terms would be small when expressed as a percentage of the base-year values. This is not necessarily the case - and this study does not look at absolute levels of productivity - but it is possible in this industry and others.

Another important factor is that many industries in this group are producers of many different kinds of products. Productivity may be increasing markedly in the manufacture of some of the products, barely increasing for others, and perhaps declining for some. Of course, this analysis is confined to the aggregate output of each industry, so that these possibly conflicting trends cannot be accounted for. This is a possibility in an industry like pulp and paper. However, industries like breweries and distilleries have a much more homogeneous output where complications of product mix are not likely to arise.

For reasons offered in Chapter Five, measures of labour productivity produced for this report are chiefly in terms of numbers of employees rather than manhours paid for. However, for the time period for which data based on manhours can be computed, namely 1961 to 1968, and for the workers for whom this is possible, namely production labour, measures of changes in output per manhour have been prepared.

Indexes of output per worker and per manhour paid for are presented in Table 21. A comparison of the 1968 indexes, output per worker divided by output per manhour (multiplied by 100), produces the reciprocals of the values in Table 7 in the previous chapter where employment by number of workers is indexed over manhours paid for. They are as follows:

See Table 22, page 109.

For 13 of the industries the index is greater than 100 although for six of them the difference is less than one percent. In these 13 industries output per worker increased somewhat more between 1961 and 1968 than output per manhour. The relative increase in manhours over number of workers means that individual employees had more hours paid for in 1968 than 1961. Increased holiday and vacation time does not raise the total number of hours because it constitutes hours paid for but not worked that were formely worked; therefore, it follows that somewhat more hours were worked by each worker in these industries in 1968 than in 1961. Eight industries have indexes of less than 100 (there is one where it is exactly 100), but none of them are as much as five percent below that value.

Of course, these seemingly minor differences assume greater magnitude if the actual percentage changes, and not index numbers, are compared. To take the most extreme case, the index of output per worker in printing and publishing, for 1968, is 124.1 and the index of output per manhour is 112.5, the former index exceeding the latter by 10.3 percent. But these indexes mean that output per worker increased 24.1 percent between 1961 and 1968 and output per manhour, 12.5 percent; the former rate is 93 percent greater than the latter. The percentage differences between these figures are given in Table 23.

Table 20

Labour Productivity Changes in Two Time-Periods Compared

	Production Labour		Total Labour	
	1961/1949	1968/1961	1961/1949	1968/1961
Slaughtering and meat processors	129.6	131.2	130.4	134.0
Bakery products	130.7	116.5	132.8	118.0
Distilleries	198.9	174.8	180.9	154.7
Breweries	196.4	141.4	178.6	129.5
Tobacco products	248.8	121.1	240.3	118.1
Rubber industries	167.2	155.4	147.1	173.9
Cotton yarn and cloth mills	175.4	130.1	161.1	126.9
Synthetic textile mills	251.9	144.9	227.1	144.2
Clothing industries	129.9	112.3	132.6	119.5
Furniture and fixtures	155.7	127.0	148.9	128.9
Saw and planing mills	163.7	128.2	166.3	136.6
Pulp and paper mills	122.0	106.7	117.8	104.6
Printing, publishing & allied industries	164.8	124.1	151.0	118.9
Iron and steel mills	179.1	126.2	165.4	125.7
Agricultural implements	114.0	149.6	91.1	159.7
Motor vehicles	192.3	193.1	175.3	208.5
Motor vehicle parts and accessories	113.3	128.3	101.5	133.6
Smelting and refining	120.2	133.1	112.9	124.9
Electrical products	190.9	132.2	163.3	139.9
Cement manufacturers	136.7	117.4	120.8	110.1
Petroleum and coal products	306.9	153.5	246.4	156.2
Chemicals	208.8	144.3	196.5	154.7
All manufacturing	158.1	134.6	164.2	124.1

Source — Table 17

Table 21

Output per Worker and Output per Manhour Compared

	Slaughtering and meat processors		Bakery products		Distilleries	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.108	1.103	1.084	1.081	1.114	1.152
1963	1.176	1.171	1.062	1.089	1.312	1.332
1964	1.268	1.262	1.062	1.100	1.382	1.400
1965	1.358	1.348	1.105	1.129	1.405	1.387
1966	1.266	1.142	1.036	1.075	1.524	1.542
1967	1.265	1.259	1.085	1.125	1.633	1.618
1968	1.312	1.319	1.165	1.200	1.748	1.748

	Breweries		Tobacco products		Rubber industries	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.127	1.108	.947	.987	1.192	1.173
1963	1.183	1.169	.980	1.054	1.142	1.142
1964	1.233	1.210	1.093	1.178	1.181	1.166
1965	1.235	1.202	1.190	1.260	1.205	1.209
1966	1.350	1.338	1.253	1.311	1.243	1.285
1967	1.382	1.402	1.231	1.297	1.420	1.459
1968	1.414	1.405	1.211	1.274	1.554	1.575

Sources Output per worker, from Table 17; output per manhour computed from data in Tables 2 and 6.

Table 21

	Cotton yarn and cloth mills		Synthetic textile mills		Clothing industries	
	per worker	per mahour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.051	1.065	1.065	1.087	1.040	1.013
1963	1.140	1.132	1.116	1.119	1.069	1.039
1964	1.226	1.183	1.148	1.164	1.059	1.032
1965	1.243	1.221	1.108	1.141	1.089	1.070
1966	1.231	1.184	1.146	1.159	1.083	1.067
1967	1.157	1.161	1.222	1.261	1.072	1.048
1968	1.301	1.362	1.449	1.489	1.123	1.098

	Furniture and fixtures		Saw and planing mills		Pulp and paper mills	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.037	.923	1.110	1.055	.972	.964
1963	1.062	1.041	1.196	1.135	1.005	.995
1964	1.080	1.060	1.271	1.192	1.042	1.021
1965	1.150	1.135	1.295	1.216	1.038	1.023
1966	1.187	1.177	1.280	1.206	1.054	1.033
1967	1.210	1.217	1.309	1.234	.991	.982
1968	1.270	1.287	1.282	1.211	1.067	1.063

Table 21

	Printing publishing and allied industries		Iron and steel mills		Agricultural implements	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.033	1.011	1.028	1.020	1.004	.992
1963	1.066	1.016	1.107	1.076	1.237	1.191
1964	1.105	1.029	1.157	1.116	1.390	1.330
1965	1.156	1.067	1.191	1.174	1.380	1.343
1966	1.218	1.089	1.128	1.116	1.373	1.314
1967	1.226	1.100	1.086	1.084	1.489	1.288
1968	1.241	1.125	1.262	1.258	1.496	1.440

	Motor vehicles		Motor vehicle parts and accessories		Smelting and refining	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.023	.972	1.121	.972	1.108	1.110
1963	1.120	1.056	1.152	1.106	1.168	1.144
1964	1.043	1.028	1.075	1.020	1.187	1.157
1965	1.180	1.135	1.190	1.113	1.178	1.130
1966	1.234	1.227	1.207	1.174	1.255	1.245
1967	1.666	1.639	1.196	1.174	1.211	1.168
1968	1.931	1.866	1.283	1.214	1.331	1.346

Table 21

	Electrical products		Cement manufacturers		Petroleum and coal products	
	per worker	per manhour	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.068	1.061	1.060	1.059	1.127	1.118
1963	1.106	1.101	1.118	1.124	1.250	1.240
1964	1.186	1.160	1.222	1.222	1.284	1.261
1965	1.209	1.196	1.248	1.207	1.416	1.426
1966	1.235	1.215	1.215	1.203	1.468	1.431
1967	1.245	1.250	1.097	1.097	1.482	1.403
1968	1.322	1.310	1.174	1.171	1.535	1.444

	Chemicals		All manufacturing	
	per worker	per manhour	per worker	per manhour
1961	1.000	1.000	1.000	1.000
1962	1.091	1.099	1.084	1.036
1963	1.123	1.122	1.122	1.069
1964	1.253	1.251	1.168	1.107
1965	1.306	1.308	1.206	1.146
1966	1.341	1.342	1.229	1.171
1967	1.382	1.378	1.263	1.209
1968	1.443	1.433	1.346	1.289

Table 22

Indexes of Output per Worker for 1968, over 1961,
Related to Output per Manhour

Slaughtering and meat processors	99.5
Bakery products	97.1
Distilleries	100.0
Breweries	100.6
Tobacco products	95.1
Rubber industries	98.7
Cotton yarn and cloth mills	95.5
Synthetic textile mills	97.3
Clothing industries	102.3
Furniture and fixtures	98.7
Saw and planing mills	105.9
Pulp and paper mills	100.4
Printing, publishing and allied industries	110.3
Iron and steel mills	100.3
Agricultural implements	103.9
Motor vehicles	103.5
Motor vehicle parts and accessories	105.7
Smelting and refining	97.4
Electrical products	100.9
Cement manufacturers	100.3
Petroleum and coal products	106.3
Chemicals	100.7
All manufacturing	104.4

Where the index in Table 22 is greater than 100 it means that the number of employees has declined relative to manhours paid for (it has either increased less or decreased more) so that output by number of employees will of course increase more than by number of manhours.

Table 23

Increase in Output per Worker, 1961 to 1968, Compared with Increase in Output per Manhour*

Slaughtering and meat processors	97.8
Bakery products	82.5
Distilleries	100.0
Breweries	101.5
Tobacco products	77.0
Rubber industries	96.3
Cotton yarn and cloth mills	83.1
Synthetic textile mills	91.8
Clothing industries	125.5
Furniture and fixtures	94.1
Saw and planing mills	133.6
Pulp and paper mills	106.3
Printing, publishing and allied industries	192.8
Iron and steel mills	101.6
Agricultural implements	112.7
Motor vehicles	107.5
Motor vehicle parts and accessories	132.2
Smelting and refining	95.7
Electrical products	103.9
Cement manufacturers	101.8
Petroleum and coal products	120.5
Chemicals	102.3
All manufacturing	119.7

*The per worker increase is expressed as a percentage of the increase per manhour.

In 12 of the industries the differences are greater than five percent and for all manufacturing the difference is almost 20 percent. Annual rates of change have not been computed on a manhours basis but in many cases they would be significantly different from those computed on a per-worker basis. For reasons already explained, it was decided not to pursue the analysis in terms of manhours. Therefore, it must suffice to point out the differences in the two measures. In any event, it makes no difference to the computation of trends in unit labour cost.

Footnotes

[1]Labour productivity was defined and its measurement explained in Chapter Two, the nature of the basic data used for its measurement was considered in Chapter Four, and the actual data that are the basis of the measures are presented in Chapter Six. Table 2 in Chapter Six contains the indexes of production and Table 3, indexes of employment that are respectively the numerator and denominator in the productivity ratio, Y/L, which is an index of output per worker.

[2]Similar matrixes have been prepared on compensation per worker, unit labour cost, unit residual cost (1949 weights), unit residual cost (1-year lagged moving weights), change in labour share, change in residual share (1949 weights), change in residual share (1-year lagged moving weights). Anyone interested in obtaining copies of any of these matrixes is invited to get in touch with the Canada Department of Labour, Economics and Research Branch.

[3]The reader is again reminded that the figures for all manufacturing are just that, for all manufacturing and not for only the particular industries selected for analysis in this study.

[4]A description of the technique used for these computations appears in Appendix C.

[5]For example, the computed annual rate of increase in output per worker (production labour only) for 1949 to 1968 for slaughtering and meat processors is 5.2 percent and the standard error is 8.3. For year one in the series, which is 1950, the computed index is 105.2; the chances are 68.26 percent that the actual value for the year is 105.2 plus or minus one standard error, that is, that the actual values lies between 96.9 and 113.5; there is a 95.46 percent chance that it lies within two standard errors, that is, between 88.6 and 121.6; and a 99.73 percent chance that it lies between three standard errors, that is, between 80.3 and 129.9. Above and below the trend line in each chart in Chapter Ten is a broken line parallel with the trend line representing one standard error plus and one standard error minus the trend values. As time passes and the trend values increase in magnitude, since the standard error does not change, its relation to the trend values, percentagewise, steadily diminishes.

[6]The trend values computed for Table 19 and similar tables on unit labour cost, etc. are computed on the basis of a linear equation or first degree parabola, of the type $Y = a + bx$ whereas a nonlinear equation may be required in some cases, such as a second degree parabola, namely $Y = a + bx + cx^2$ or a higher degree parabola of the type, $Y = a + bx + cx^2 \ldots\ldots + zx^{n-1}$. This is discussed in Appendix C.

[7]We point out once more that smelting and refining, one of the 22 industries studied, is excluded from the averaging with respect to 1949-1968 measures. The reason is given in Chapter Six, the section on production and value added.

CHAPTER EIGHT

Unit Labour Cost of Production

Changes in the cost of producing a unit of output reflect changes in the required quantity of each factor of production (i.e. changes in productivity) and in the unit price of each factor. In the case of labour requirements, the formula, as described in Chapter Three, is W/Y, which simply means that changes in unit labour cost are measured by dividing the change in total payroll by the change in total output (each change being expressed as an index number). The resulting measure is the same as that derived from dividing the index of wages paid per worker by the index of output per worker (see Chapter Three).

While this is elementary, it is important to emphasize that we cannot assess movements in labour costs by reference to wage movements alone; such changes must be related to changes in productivity. To use an obvious example, if the average wage per worker doubles at the same time as output per worker also doubles, then the money labour cost of producing a unit of output - that is, the amount of wages that must be paid to obtain production of a unit of output - has not changed.[1]

Trends in labour productivity were examined in Chapter Seven and wage trends in Chapter Six. It is the next logical step to consider the net effect of these trends as expressed in labour costs. Annual wages per worker are indexed on 1949 in Table 9A, annual wages and salaries per worker are similarly indexed in 9B, and they are both indexed on 1961 in 9C. Indexes of output per worker are found in Table 17. Table 24 contains indexes of unit labour cost which are in effect the quotients (expressed in index form) of the indexes in Table 9 divided by the indexes in Table 17. As with most indexes appearing in this study, they have been drawn from computer printouts containing matrixes of unit labour cost where the data are indexed on each year from 1949 to 1967. For reasons already given[2], 1949 and 1961 base years are used in Table 24, as elsewhere.

Two characteristics ascribed to productivity also apply to the behaviour of unit labour cost of production. The first is the considerable variation in the experience of the industries studied; the second is the substantial fluctuations through time, which are even greater for unit labour cost than for productivity. The former is illustrated by the fact that, with respect to production labour, experience ranged from an increase, between 1949 and 1968, of as much as 95.2 percent for pulp and paper to a decrease of 37.9 percent for synthetic textiles; and, with respect to total labour, from an increase as high as 102.5 percent for cement manufacturers to a decrease of 23.8 percent for synthetic textiles.

Data for the industries covered by this study have been averaged (unweighted) and appear in Table 32. The average unit labour cost index for 1968 over 1949 is 120.3 for production labour only, and 128.6 for total labour; but this more substantial increase for total labour did not occur in the more recent years because Table 32 shows that the average indexes for 1968 over 1961 are 106.7 and 105.1 for production and for total labour respectively. However, this contrast does not apply to all manufacturing (which, of course, comprises the industries examined here plus all the manufacturing industries not covered by this study); it will be seen from Table 33 that for both the 1949-1968 and 1961-1968 periods the index with respect to total labour exceeds the index with respect to production labour.

The reader has already been warned of the danger of relying too much on index numbers rather than trend rates and it is well illustrated here. The trend values appearing in Table 26, are averaged for the covered industries in Table 32 and are summarized for all manufacturing in Table 33. For all manufacturing the annual rate of increase in unit labour cost for the full 1949-1968 period was less than half of the rate for the more recent 1961-1968 period: 0.5 percent and 0.7 percent for production and total labour respectively, compared with 2.0 percent and 1.9 percent. And while the 1968 index over 1961 shows a greater increase *between* those *two years* in unit total labour than in unit production labour cost, the average annual rate of increase over those years was actually slightly greater for production labour only. For the longer time period total labour does show a somewhat greater rate of increase.

When the all-manufacturing data are compared with the covered industry averages, there are some interesting differences. The first three of the four labour cost indexes are similar, but there is a marked difference in the case of the 1968/1961 indexes for total labour, the 22-industry average being 105.1, the all-manufacturing index, 117.6. The covered industries make up most of those entering into all manufacturing but since the average is unweighted, it means that some

Table 24

Indexes of Unit Labour Cost

	Slaughtering and meat processors			Bakery products			Distilleries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	104.6	105.0		101.7	101.1		100.4	99.4	
1951	122.4	122.8		107.1	106.2		104.7	101.0	
1952	120.2	116.9		112.8	111.4		115.3	108.9	
1953	129.7	128.8		116.1	114.5		111.6	103.0	
1954	122.2	123.9		118.5	117.1		122.3	111.3	
1955	120.5	120.0		123.2	120.6		130.0	115.8	
1956	128.0	126.3		125.0	122.1		124.9	109.5	
1957	133.8	133.3		132.4	130.2		127.9	115.5	
1958	135.0	133.9		137.0	134.7		121.3	111.7	
1959	140.1	136.7		138.5	135.9		114.4	108.2	
1960	146.0	144.4		142.6	141.2		108.5	107.9	
1961	137.9	137.4	100.0	139.4	136.6	100.0	102.9	109.8	100.0
1962	130.1	129.0	93.8	137.3	137.2	100.4	95.5	105.3	95.9
1963	124.6	122.2	88.9	144.7	143.9	105.3	85.4	96.6	88.0
1964	120.8	118.6	86.3	150.1	148.3	108.5	84.9	95.7	87.1
1965	117.4	117.4	85.4	152.9	152.7	111.7	89.9	101.5	92.6
1966	133.9	133 2	96.9	169.0	164.8	120.6	85.3	96.1	87.5
1967	144.1	137.7	100.2	171.4	165.4	121.1	85.3	97.0	88.3
1968	147.1	141.5	103.0	172.9	166.0	121.5	85.6	100.1	91.1

Sources Tables 2 and 8

Table 24

	Breweries			Tobacco products			Rubber industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	97.8	102.5		99.6	100.8		98.2	96.0	
1951	111.7	116.7		114.2	116.4		108.5	107.3	
1952	109.2	110.3		103.0	104.5		115.3	116.4	
1953	108.8	109.6		101.2	101.4		109.5	109.7	
1954	113.3	116.6		101.1	100.3		117.2	119.3	
1955	107.8	113.3		97.0	95.7		110.2	110.2	
1956	109.1	116.7		91.5	90.8		107.7	107.8	
1957	105.0	110.2		91.9	91.7		112.1	115.1	
1958	108.7	115.2		93.4	94.0		99.9	104.9	
1959	107.8	114.7		89.5	91.1		99.9	102.9	
1960	106.9	116 9		83.1	85.9		110.8	116.1	
1961	101.1	110.7	100.0	81.5	84.2	100.0	113.2	115.2	100.0
1962	93.7	105.6	95.4	85.4	90.1	107.0	100.0	95.2	82.6
1963	90.5	105.0	94.8	85.8	86.1	102.3	104.8	100.4	87.2
1964	90.4	107.5	97.1	81.2	83.3	98.9	107.6	104.3	90.5
1965	95.6	114.7	103.5	80.2	81.7	97.0	110.4	107.8	93.6
1966	93.5	113.1	102.1	80.3	82.4	97.8	110.8	106.1	92.1
1967	94.0	114.4	103.3	87.9	93.1	110.5	105.2	103.6	90.0
1968	102.3	122.7	110.8	99.0	106.1	125.9	103.0	104.8	90.9

Table 24

	Cotton yarn and cloth mills			Synthetic textile mills			Clothing industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	94.8	95.5		91.7	96.2		100.1	101.3	
1951	104.5	106.4		88.6	92.4		106.5	107.0	
1952	118.9	124.9		84.6	93.3		106.0	104.5	
1953	118.3	124.3		84.6	92.0		111.5	109.2	
1954	102.6	109.6		82.8	96.7		109.6	108.3	
1955	110.6	122.6		76.5	89.0		107.6	105.9	
1956	112.9	126.9		77.1	91.1		108.0	105.8	
1957	105.3	119.9		78.6	92.8		111.4	110.8	
1958	92.6	110.2		72.0	87.8		110.8	109.9	
1959	92.0	107.8		65.1	79.5		114.4	112.7	
1960	93.6	107.9		65.6	78.2		114.2	114.4	
1961	89.5	101.6	100.0	61.2	77.0	100.0	116.5	113.7	100.0
1962	89.7	101.2	99.6	59.1	73.2	95.1	119.5	113.1	99.5
1963	86.3	97.5	95.9	60.2	72.7	94.3	119.8	112.0	98.5
1964	87.8	97.6	96.1	61.7	73.9	94.7	126.2	116.3	102.3
1965	88.7	98.6	97.0	65.9	78.8	102.3	128.8	118.8	104.5
1966	97.0	111.0	109.2	67.1	82.1	106.5	136.9	124.7	109.6
1967	107.4	123.9	121.8	64.7	77.8	101.0	146.0	132.6	116.6
1968	98.4	116.8	114 8	62.1	76.2	98.9	150.5	134.6	118.3

Table 24

	Furniture and fixtures			Saw and planing mills			Pulp and paper mills		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	98.6	99.7		101.7	102.0		99.0	99.4	
1951	102.9	105.3		112.3	112.3		114.8	114.6	
1952	105.1	108.4		115.2	116.7		125.7	126.6	
1953	109.5	112.1		113.2	115.6		126.6	127.2	
1954	109.7	112.8		113.0	115.4		130.7	131.2	
1955	108.3	111.5		111.1	114.2		132.7	133.2	
1956	110.6	113.4		113.4	117.4		137.3	138.6	
1957	115.0	119.5		116.0	120.6		144.2	148.1	
1958	115.3	121.0		114.6	119.3		144.6	151.0	
1959	115.6	121.7		110.2	115.3		139.9	145.9	
1960	115.4	122.1		110.1	114.9		140.0	147.7	
1961	110.1	116.1	100.0	109.3	113.5	100.0	145.9	143.4	100.0
1962	111.4	116.1	99.9	104.9	105.0	92.5	155.1	153.3	106.8
1963	112.2	120.3	103.6	102.9	103.7	91.4	153.7	151.9	105.8
1964	115.9	119.1	102.5	100.9	99.9	88.0	154.4	151.4	105.6
1965	113.6	115.9	99.8	104.9	102.9	90.7	161.9	158.9	110.8
1966	117.0	118.9	102.4	114.0	111.5	98.3	175.1	171.3	119.4
1967	120.5	123.6	106.4	118.8	116.3	102.5	195.9	192.4	134.2
1968	122.8	126.2	108.7	131.5	128.7	113.5	195.2	193.9	135.2

Table 24

	Printing, publishing and allied industries			Iron and steel mills			Agricultural implements		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	98.9	98.9		95.2	96.6		118.5	118.9	
1951	105.8	106.3		101.4	103.3		139.5	137.9	
1952	115.2	116.5		115.9	117.9		151.6	149.3	
1953	116.8	117.4		120.7	123.2		152.5	160.9	
1954	114.0	116.7		112.0	120.2		165.9	183.8	
1955	117.0	119.3		102.2	106.0		179.2	192.3	
1956	109.8	116.0		100.3	103.3		167.3	186.1	
1957	113.9	120.7		117.2	123.7		172.9	190.2	
1958	123.5	127.9		116.6	128.8		168.9	184.0	
1959	119.1	125.7		108.8	116.5		183.4	195.8	
1960	119.9	130.0		117.2	127.9		177.3	209.1	
1961	116.7	128.8	100.0	108.0	118.2	100.0	152.8	192.4	100.0
1962	120.2	131.0	101.7	107.7	117.2	99.2	162.9	192.8	100.3
1963	119.4	132.1	102.5	105.3	114.8	97.1	141.9	158.7	82.5
1964	119.4	130.8	101.6	103.0	111.8	94.6	133.0	149.3	77.6
1965	118.9	134.0	104.1	102.5	110.7	93.6	132.1	149.9	77.9
1966	118.2	135.8	105.4	111.1	121.2	102.5	141.8	159.0	82.7
1967	122.5	140.9	109.4	121.6	135.0	114.2	149.1	168.7	87.7
1968	127.9	146.6	113.8	110.1	122.3	103.5	141.5	170.5	88.6

Table 24

	Motor vehicles			Motor vehicle parts and accessories			Smelting and refining		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	96.0	95.4		94.9	93.8		100.2	101.1	
1951	92.7	92.1		106.0	105.8		119.6	120.2	
1952	97.5	98.4		116.3	116.8		138.4	139.5	
1953	104.5	102.8		119.8	121.6		135.0	136.1	
1954	99.7	107.8		117.3	125.6		143.1	146.2	
1955	99.3	104.1		112.7	120.5		148.9	153.0	
1956	102.5	108.0		116.6	124.1		158.0	162.0	
1957	103.8	113.7		117.8	129.8		163.0	171.2	
1958	107.1	121.8		118.4	133.8		157.3	173.3	
1959	117.5	129.7		113.6	125.4		157.9	169.1	
1960	121.0	134.2		113.2	127.2		150.8	159.7	
1961	100.3	109.8	100.0	163.5	187.7	100.0	151.6	164.3	100.0
1962	110.5	113.8	103.7	156.4	173.4	92.4	139.3	152.7	92.9
1963	108.3	108.6	99.0	159.0	171.9	91.6	134.0	152.9	93.1
1964	113.4	114.1	103.9	179.0	191.4	102.0	137.5	153.1	93.1
1965	111.7	107.7	98.1	174.9	187.9	100.1	145.7	162.3	98.7
1966	106.0	105.9	96.5	166.0	179.2	95.5	141.7	164.2	99.9
1967	81.2	80.9	73.7	173.4	187.6	100.0	161.4	180.7	110.0
1968	81.2	80.7	73.5	187.6	201.2	107.2	152.2	178.3	108.5

Table 24

	Electrical products			Cement manufacturers			Petroleum and coal products		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	99.9	100.5		106.0	105.9		92.6	99.7	
1951	113.5	117.4		123.3	123.2		93.3	101.7	
1952	119.6	127.2		143.4	144.0		103.6	114.0	
1953	111.4	121.0		133.7	133.8		99.7	108.9	
1954	107.6	124.1		141.7	146.8		94.9	106.2	
1955	95.2	110.0		141.0	147.8		83.3	95.7	
1956	100.1	114.5		139.4	151.0		77.8	92.2	
1957	105.9	127.2		134.0	147.4		82.4	97.9	
1958	102.1	128.4		132.1	152.0		79.1	97.9	
1959	98.4	121.0		135.8	160.3		72.8	93.7	
1960	93.5	117.7		143.0	170.9		72.4	92.8	
1961	88.9	112.0	100.0	135.2	160.0	100.0	68.7	88.5	100.0
1962	85.6	103.6	92.5	132.0	157.3	98.3	63.9	81.5	92.2
1963	85.2	101.9	91.0	128.2	154.6	96.6	59.0	74.8	84.5
1964	82.8	97.9	87.5	122.0	147.9	92.4	60.3	76.9	86.9
1965	84.0	98.2	87.5	131.2	157.2	98.2	55.6	72.4	81.9
1966	85.9	99.0	88.4	140.6	167.6	104.8	60.2	76.3	86.3
1967	88.0	100.9	90.1	160.4	199.8	124.9	64.1	80.9	91.5
1968	90.3	97.4	87.0	161.3	202.5	126.6	66.5	78.4	88.6

Table 24

	Chemicals			All manufacturing		
	Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0	
1950	97.4	97.4		99.4	100.4	
1951	107.6	105.4		108.3	109.3	
1952	112 6	110.7		115.1	116.9	
1953	112.1	110.1		116.4	118.6	
1954	109 3	109.0		114.2	119.5	
1955	103.7	105.1		110.5	115.7	
1956	99.4	103.7		111.3	116.8	
1957	100.3	105.8		115.5	123.4	
1958	96.2	104.6		114.9	125.4	
1959	99.2	105.6		113.6	123.3	
1960	99.9	106.9		133.3	124.2	
1961	93.6	101.1	100.0	115.0	111.2	100.0
1962	88.7	96.7	95.6	111.0	118.9	106.9
1963	89.2	97.1	96.0	111.2	118.8	106.8
1964	82.6	89.6	88.6	111.7	118.2	106.2
1965	81.7	89.3	88.3	113.9	119.8	107.7
1966	84.5	89.9	88.8	118.2	124.3	111.8
1967	87.3	86.9	85.9	121.6	129.2	116.1
1968	89.6	83.8	82.8	123.0	130.8	117.6

Table 25

Unit Labour Cost Indexes, in Each Industry,
Indexed on the All-Manufacturing Index

	Production labour		Total labour	
	1968/1949	1968/1961	1968/1949	1968/1961
Slaughtering and meat processors	119.6	99.8	108.2	87.6
Bakery products	140.6	116.0	126.9	103.3
Distilleries	69.6	77.8	76.5	77.5
Breweries	83.2	94.7	93.8	94.2
Tobacco products	80.5	113.7	81.1	107.1
Rubber industries	83.7	85.1	80.1	77.3
Cotton yarn and cloth mills	80.0	102.8	89.3	97.6
Synthetic textile mills	50.5	94.9	58.3	84.1
Clothing industries	122.4	120.9	102.9	100.6
Furniture and fixtures	99.8	104.4	96.5	92.4
Saw and planing mills	106.9	112.5	98.4	96.5
Pulp and paper mills	158.7	125.2	148.2	115.0
Printing, publishing & allied industries	104.0	102.6	112.1	96.8
Iron and steel mills	89.5	95.3	93.5	88.0
Agricultural implements	115.0	86.6	130.4	75.3
Motor vehicles	66.0	75.8	61.7	62.5
Motor vehicle parts and accessories	152.5	107.4	153.8	91.2
Smelting and refining	123.7	93.9	136.2	92.3
Electrical products	73.4	95.0	74.5	74.0
Cement manufacturers	131.1	111.6	154.8	107.7
Petroleum and coal products	54.1	90.6	59.9	75.3
Chemicals	72.8	89.6	64.1	70.4

Source Table 24

Table 26

Annual Rate of Change*, Unit Labour Cost

	Production labour 1949-1968			Total labour 1949-1968			Production labour 1961-1968			Total labour 1961-1968		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	0.9	9.5	.552	0.8	8.9	.496	3.0	6.3	.702	2.5	5.5	.680
Bakery products	3.5	4.6	.977	3.4	3.5	.984	4.6	2.5	.973	3.8	2.3	.969
Distilleries	−1.6	11.7	.703	−0.5	6.0	.461	−1.1	3.4	.574	−0.5	3.4	.316
Breweries	−0.8	5.7	.687	0.2	5.0	.206	1.3	3.1	.693	2.6	2.3	.925
Tobacco products	−1.1	6.7	.726	−1.0	7.7	.593	1.9	7.6	.516	2.7	9.4	.542
Rubber industries	−0.2	5.6	.160	−0.4	7.8	.252	0.4	3.6	.258	2.4	5.1	.676
Cotton yarn and cloth mills	−0.9	9.2	.518	−0.3	10.7	.183	3.2	5.8	.782	4.2	6.6	.818
Synthetic textile mills	−2.0	4.9	.893	−1.4	4.6	.853	1.3	4.3	.601	1.4	4.0	.613
Clothing industries	2.2	5.9	.908	1.4	4.3	.881	3.5	11.4	.613	3.7	2.3	.964
Furniture and fixtures	0.9	3.1	.855	0.9	3.9	.817	1.6	1.4	.934	1.1	2.4	.752
Saw and planing mills	0.2	7.1	.176	0.0	7.5	.021	4.5	5.4	.871	4.0	5.5	.827
Pulp and paper mills	3.7	8.6	.939	3.4	8.9	.927	5.5	5.4	.923	5.6	5.7	.917
Printing, publishing & allied industries	0.8	4.4	.753	1.9	3.6	.953	0.8	2.5	.644	2.0	2.0	.912
Iron and steel mills	0.2	7.6	.164	0.7	8.9	.462	1.6	5.5	.563	2.1	6.1	.603
Agricultural implements	−0.3	18.7	.153	0.5	23.8	.191	−0.8	7.7	.256	−0.8	8.4	.192
Motor vehicles	0.0	10.8	.012	0.0	14.2	.049	−4.4	9.1	.808	−4.9	7.4	.482
Motor vehicle parts and accessories	5.1	13.0	.906	5.9	12.9	.931	2.4	4.8	.759	2.2	4.0	.756
Smelting and refining	1.0	14.0	.461	2.0	13.8	.741	2.5	4.1	.793	3.4	3.0	.926
Electrical products	−1.5	6.2	.841	−1.1	9.0	.638	1.0	2.1	.706	−0.7	1.8	.642
Cement manufacturers	0.9	11.3	.475	2.7	12.7	.833	5.0	6.8	.841	6.1	8.1	.847
Petroleum and coal products	−2.4	6.2	.914	−1.8	5.7	.895	1.0	5.4	.376	0.1	4.0	.054
Chemicals	−1.4	5.1	.859	−1.1	5.0	.815	0.4	3.8	.024	−2.2	1.9	.932
All manufacturing	0.5	4.1	.615	0.7	5.4	.668	2.0	1.3	.958	1.9	2.2	.910

*percentage rate, computed by least squares of actual values

S — standard error of estimate

R — goodness of fit ratio

Source Table 24

of the larger industries experienced greater increases in unit total labour cost in 1968 over 1961 than some of the smaller industries; this is reflected in the all-manufacturing figure but does not, for the reason just given, affect the average in Table 32. Furthermore, there are no such differences in the annual trend rates.

An examination of Table 26 reveals the following high and low rates of change:

	high	low
Production labour		
1949–1968	3.7 (pulp and paper mills)	–2.4 (petroleum and coal prod.)
Total labour		
1949–1968	3.4 (bakery products, pulp and paper mills)	–1.8 (petroleum and coal prod.)
Production labour		
1961–1968	5.5 (pulp and paper mills)	–4.4 (motor vehicles)
Total labour		
1961–1968	6.1 (cement manufacturers)	–4.9 (motor vehicles)

Whatever the average rate of change may be, there is, clearly, great variation among the industries, as exhibited by this wide range.

The interindustry variation is more fully demonstrated in Table 32 by the standard deviations and coefficients of variation with respect to the indexes and the annual trend rates. The coefficients are much higher for 1949-1968 than for 1961-1968, and the coefficients relating to annual trend rates are extremely high, compared with those for the 1968 index numbers. There is obviously much more interindustry variation among annual rates of change in unit labour cost than in productivity. However, Table 32 also reveals far less interindustry variation for compensation per worker than for productivity or unit labour cost.

It will also be observed from Tables 32 and 33 that unit labour cost exhibited a much smaller annual rate of change than either compensation per worker or output per worker. This is to be expected since unit labour cost represents the difference between changes in compensation and output per worker (more correctly, it is the change in one divided by the change in the other).

From Table 32 it can be concluded that for the industries this study has examined, there is no typical or representative rate of change in unit labour cost. This is also demonstrated by the wide range of indexes appearing in Table 24 and by a frequency distribution of the number of industries falling within intervals of 25 points each with respect to the relative indexes in Table 25, which is as follows:

	In relation to			
Index range	Production workers		Total labour	
	1968/1949	1968/1961	1968/1949	1968/1961
	(number of industries)			
50–75	6	–	5	5
75–100	6	12	8	13
101–125	6	10	3	4
126–150	2	–	4	–
151–175	2	–	2	–

The distribution is, however, more concentrated in the more recent 1961-1968 period than for 1949-1968, which is also illustrated by the lower coefficients of variation in Table 32 for the more recent period.

In addition to the greater interindustry variation in unit labour cost, compared with compensation and productivity, the other most notable characteristic is the greater fluctuations over time of unit labour cost compared with the other two series. This is easily seen in Table 32 and from a comparison of Tables 11, 19 and 26. This does not mean that unit labour cost has not changed through time according to some kind of pattern but that the trend is often not straight-line.

This can be deduced from a comparison of the R (goodness of fit)[3] values for the trend rates for the three series. All of the average R values in Table 32 for compensation and output per worker are higher than for unit labour cost. While there are only two R values of less than .9 for output per worker (production labour) and five for the same measure (total labour), both for the 1949-1968 period, and while there are no R values of less than .9 for either of the worker compensation series for 1949-1968, for unit labour costs there are only five with .9 or more for the production labour series and only two in the total labour series for the full time period. For all manufacturing the R values for unit labour costs are .615 and .668 for production and for total labour respectively.

However, unit labour cost moved along a somewhat smoother trend line in the more recent 1961-1968 period. This can be seen from the higher R values shown in Table 32, and from the fact that for all manufacturing they are .958 and .910 for the recent period compared with .615 and .668 for the full period. However, Table 26 shows only three R's of at least .9 for production labour and seven for total labour compared with eight and nine respectively for output per worker while there was only one R under .9 for compensation per worker, production labour, and none under .9 with respect to total labour.

Some of the more notable fluctuations are indicated in the charts in Chapter Ten and the tables containing the data on which the actual values are based. For example, from the production labour series, for slaughtering and meat processors an increase in unit labour costs of 21.2 percent between 1955 and 1960 was followed by a decline of 19.6 percent over the next five years, followed by an increase of 25.4 percent in the next three years. At the same time changes in output per worker were moderate for the first five years considered, an increase of 4.8 percent, and for the last three years, a decline of 3.4 percent, but were large, 45.7 percent for the five years, 1960 to 1965. The changes in compensation per worker were less erratic. Similar patterns can be discerned for the other industries.

Wages and salaries can be expected to follow a more steady trend line than productivity or costs because of the manner in which changes in wages and employment take place, the practice of collective bargaining and so on. Productivity can be expected to behave fitfully, to increase or decrease in spurts from time to time, depending on many things such as the rate of investment, the nature and rate of technological change, degree of plant and other capacity utilization, and so on.

It is not altogether clear, without benefit of further research, why unit labour costs should fluctuate more and show considerably more nonlinearity than movements in labour productivity or wages paid per worker. Since changes in unit labour cost are the resultant of changes in wages per worker divided by changes in output per worker, it might be expected that the effect would be to dampen movements in the unit cost figures. Of course, this does happen to the rate of change since movements in labour productivity offset or cancel out wage movements. But we are concerned here not with the annual rate of change but with fluctuations in that rate, and there is no *a priori* reason why fluctuations in productivity and compensation should offset each other; sometimes they may and at other times they may reinforce each other. Therefore, the result is that unit labour costs are less stable than either output or compensation per worker.

One conclusion that can be drawn is that since wage and salary changes follow a much steadier trend than labour productivity over the years, it is changes in the latter that are the decisive element in determining changes in unit labour costs. Since labour productivity moves fitfully, compared with compensation per worker, unit labour cost is likely to move in a similarly fitful manner.

This does not mean that if compensation per worker has steadily been increasing more than output per worker, it is to be minimized as a factor responsible for rising unit labour costs. In some industries this has been happening just as the opposite has been occurring in other industries. But the more typical pattern seems to be one of upward and downward fluctuations in unit labour costs reflecting (usually conversely) similar fluctuations in labour productivity. However, to add one more qualification: the rate of change in wages and in combined wages and salaries, while usually steadier, over time, than that for productivity or unit costs, does show periods of acceleration or deceleration, which certainly have influenced unit labour costs. The years immediately leading up to 1968 were mostly years of an accelerating rate of increase in labour compensation.

It was observed in the previous chapter that labour productivity increased less from 1961 to 1968 than for the entire 1949-1968 period. Conversely, as one would expect, unit labour costs rose more; the annual rates for all manufacturing, as shown in Table 33 were 2.0 percent and 1.9 percent for 1961 to 1968 for production and total labour respectively and 0.5 and 0.7 percent for 1949 to 1968. This also holds true, on the average, for the industries covered by this study, as indicated in Table 32.

A comparison of indexes of unit labour costs for 1961 over 1949 and 1968 over 1961 appears in Table 27 which is comparable to Table 20 that made the same comparisons for labour productivity. Bearing in mind the different length of the two time periods, twelve years for the earlier period and seven for the later,[4] we see that the all-manufacturing increases are not very different for the two periods with respect to production labour (an average annual increase of 11.2 percent over the twelve years compared with 7.0 percent for the seven years), but the difference is quite marked with respect to total labour, 21.8 percent compared with 5.0 percent. For the full period unit total labour cost rose more than unit production labour cost; this is so for all manufacturing and on the average for the industries covered here.[5] However, over the more recent period the performance of this measure relative to production labour was rather similar to that for total labour.

The differences in the performance of unit labour costs in these two periods in the various industries are examined in Chapter Ten.

Table 27

Unit Labour Costs in Two Time-Periods Compared

	Production Labour		Total Labour	
	1961/1949	1968/1961	1961/1949	1968/1961
Slaughtering and meat processors	137.9	106.7	137.4	103.0
Bakery products	139.4	124.0	136.6	121.5
Distilleries	102.9	83.2	109.8	91.1
Breweries	101.1	101.2	110.7	110.8
Tobacco products	81.5	121.5	84.2	125.9
Rubber industries	113.2	91.0	115.2	90.9
Cotton yarn and cloth mills	89.5	109.9	101.6	114.8
Synthetic textile mills	61.2	101.4	77.0	98.9
Clothing industries	116.5	129.2	113.7	118.3
Furniture and fixtures	110.1	111.6	116.1	108.7
Saw and planing mills	109.3	120.3	113.5	113.5
Pulp and paper mills	145.9	133.8	143.4	135.2
Printing, publishing & allied industries	116.7	109.7	128.8	113.8
Iron and steel mills	108.0	101.9	118.2	103.5
Agricultural implements	152.8	92.6	192.4	88.6
Motor vehicles	100.3	81.0	109.8	73.5
Motor vehicle parts & accessories	163.5	114.8	187.7	107.2
Smelting and refining	151.6	100.4	164.3	108.5
Electrical products	88.9	101.6	112.0	87.0
Cement manufacturers	135.2	119.3	160.0	126.6
Petroleum and coal products	68.7	96.8	88.5	88.6
Chemicals	93.6	95.8	101.1	92.8
All manufacturing	115.0	106.9	111.2	117.6

Source Table 24

Footnotes

[1]The index of unit labour cost would be 100 because the index of wages per worker, of 200, divided by the index of output per worker, of 200, yields 100, when the quotient is expressed as an index number.

[2]See second paragraph, Chapter Seven.

[3]The significance of this measure has already been discussed in Chapter Seven.

[4]The reasons for choosing these time periods are explained in Chapter Seven.

[5]As the reader knows, this study does not directly compare production and nonproduction labour, but only production labour and total labour, the latter comprising production and nonproduction labour. Thus, it follows that if the rate of unit cost increase held steady for production labour and increased for total labour, it increased even more for nonproduction labour only.

CHAPTER NINE

Unit Residual Cost, Changes in Unit Costs and Prices, Change in Factor Shares

It will be recalled from Chapter Three that value added, in current dollars, is equal to the sum of total payments for labour and residual inputs. The residual input is not, in this study, referred to as capital not only because advertising and research are sometimes included but also for conceptual and definitional reasons and because of the problems associated with trying to measure capital, which is not attempted here.[1] It is, therefore, more prudent to refer to the nonlabour input as the residual.[2]

Since the actual quantity of this residual input is not measured, it is not possible to estimate its productivity or changes in unit price. However, the total money outlay for the residual can be obtained for each year simply by subtracting total wages and salaries (total wages only, in the case of production labour) from value added. When this is indexed and divided, for each year, by the index of real output, the result (when multiplied by 100) is a current-weighted index of unit residual cost, that is, R/Y.[3]

The reason for our measuring change in unit residual cost is so that labour and nonlabour (in some cases, nonproduction labour) costs of production can be compared. It is emphasized throughout this study that rising unit factor cost cannot automatically be accepted as the cause of rising prices. As suggested earlier, costs may indeed push up prices; on the other hand, demand may pull up prices which in turn pull up the prices of the factors of production, leading to higher unit costs. It is beyond the scope of this research to determine in each case whether there has been cost-push or demand-pull or some combination of the two.

A comparison of unit labour cost and unit residual cost with implicit (value-added) price reveals any shift in the share of total income accruing from total output that goes to each factor (labour and the residue).[4] The share of income going to labour increases in relation to the share going to the residual if unit labour cost declines less than the decline in unit residual cost; or increases more; or increases while unit residual cost declines. Of course, if the converse is true, the labour share is reduced.

In the rest of this chapter attention turns first to unit residual cost, then to the relation of unit labour and unit residual cost to implicit (value-added) price change, and finally, to changes in the factor shares. As in Chapters Six, Seven and Eight, the general picture is examined here, leaving to Chapter Ten a more detailed industry-by-industry analysis.

Unit residual cost

Table 28 contains indexes of unit residual cost, Table 29 compares the three measures of unit residual cost, Table 30 contains relative indexes, showing the performance of each industry compared with the all-manufacturing average, and Table 31 presents the annual linear trend rate of change, and the usual goodness of fit measures for each industry.

The first measure of unit residual cost is related to production labour and value added by manufacturing activity; separate series have been prepared for the full 1949-1968 period and the shorter period from 1961 to 1968. The residual in the first measure includes a labour element, namely, wages and salaries for nonproduction labour; this can be substantial in industries with a large nonproduction payroll. The second measure is related to total labour, meaning all wages and salaries and other payroll items are deducted from value added by manufacturing; as with the first measure, separate series have been prepared for the full period and the shorter, recent one. The third measure is related to total labour and, unlike the first two, to value added by total activity; because data on value added, total, have only been published since 1961, it covers only the shorter time period, 1961-1968.[5]

Given the basic data used for this study, it is impossible to know whether unit residual cost has risen in a given instance because of an increased use of capital, a rise in the cost of capital or of such overhead expenses as rent, maintenance of buildings and equipment (aside from fuel and energy which, the reader will recall, are inputs from outside and not part of value added), greater expenditures on research and advertising; or, and this is important, because of increased profit per unit of output.

Table 28

Indexes of Unit Residual Cost

	Slaughtering and meat processors			Bakery products			Distilleries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	97.6	95.5		103.4	104.6		113.8	115.2	
1951	110.9	107.6		115.4	118.4		113.1	114.9	
1952	128.3	133.4		121.8	125.5		114.7	116.3	
1953	125.5	125.2		119.5	122.2		107.5	109.4	
1954	118.5	116.0		111.6	111.8		118.4	121.0	
1955	126.8	128.8		112.4	113.1		117.6	120.5	
1956	108.6	105.3		107.5	107.0		110.0	112.8	
1957	118.1	114.7		117.5	116.8		119.1	121.7	
1958	117.1	113.7		120.6	119.7		120.2	122.6	
1959	119.3	117.2		120.0	119.0		121.7	124.0	
1960	117.1	111.4		122.3	119.4		129.2	131.2	
1961	103.0	94.8	100.0	129.3	130.4	100.0	127.3	127.6	100.0
1962	108.2	103.8	110.7	126.0	123.6	95.2	124.7	124.7	97.0
1963	102.7	99.4	106.0	129.6	127.2	98.6	127.1	127.8	100.3
1964	104.8	102.8	111.6	136.5	135.7	105.4	133.3	134.7	105.7
1965	101.9	98.0	107.9	140.5	138.0	107.8	133.4	134.2	105.5
1966	122.5	120.3	130.0	146.3	146.2	113.6	134.0	135.5	106.3
1967	132.6	135.6	146.8	142.7	143.6	110.8	132.1	133.2	104.4
1968	121.3	120.1	127.2	142.1	143.5	113.1	136.7	137.4	108.4

Note: These indexes are based on 1949 weights (ratio of payroll to value added) for the first two columns for each industry and 1961 weights for the third column. The indexes in the first two columns are related to value added by manufacturing activity and those in the third column are related to value added by total activity.

Source derived by computation based on formula described in the text.

Table 28

	Breweries			Tobacco products			Rubber industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	104.8	103.9		112.5	113.3		119.7	127.1	
1951	109.6	107.9		101.4	98.5		137.0	145.3	
1952	105.7	105.1		111.5	111.6		147.8	155.2	
1953	118.1	118.5		108.6	109.3		134.9	141.3	
1954	119.5	119.0		109.4	110.9		128.8	129.8	
1955	122.3	121.8		112.4	115.0		143.6	152.2	
1956	119.1	117.6		102.1	103.9		131.5	137.5	
1957	118.6	118.1		90.4	90.4		117.4	116.1	
1958	123.5	122.7		93.8	93.5		120.7	121.5	
1959	122.4	121.4		104.5	105.3		108.5	108.0	
1960	124.1	122.5		105.7	106.7		109.6	104.6	
1961	128.2	127.4	100.0	115.5	118.1	100.0	109.8	107.1	100.0
1962	125.7	124.6	99.6	110.4	110.7	93.1	85.4	93.9	81.3
1963	127.7	126.3	100.6	111.3	114.2	97.0	88.9	88.8	87.1
1964	132.5	130.7	104.3	105.9	107.6	92.9	93.5	92.8	88.8
1965	130.7	127.8	102.0	122.7	127.0	107.6	103.0	103.4	98.8
1966	130.0	127.0	100.8	126.9	131.4	110.8	108.6	112.2	107.7
1967	132.2	129.1	103.5	137.4	140.4	118.6	112.1	115.3	109.4
1968	139.5	136.3	108.2	131.4	131.2	110.1	115.7	117.3	111.7

Table 28

	Cotton yarn and cloth mills			Synthetic textile mills			Clothing industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	101.4	101.6		105.8	104.7		97.9	95.4	
1951	104 7	102 0		99.3	98.0		102.6	100.5	
1952	98.6	86.0		99.5	94.6		102.7	103.8	
1953	76.9	60.5		75.2	66.4		101.7	101.6	
1954	83.0	69.1		77.8	64.0		96.8	94.2	
1955	88.2	66.5		78.9	67.9		98.9	98.2	
1956	108.5	87.2		66.8	51.8		95.2	93.9	
1957	111.2	90.8		71.5	57.0		100.0	96.8	
1958	102.5	78.6		75.1	61.3		101.1	99.0	
1959	110.1	90.3		82.5	73.0		104.0	102.6	
1960	116.0	99.1		83.5	75.8		105.4	101.9	
1961	118.9	106.6	100.0	85.6	76.3	100.0	101.9	100.7	100.0
1962	119.8	108.4	101.1	88.2	81.3	106.9	103.7	107.2	106.5
1963	127.4	118.4	109.8	93.8	89.4	116.9	105.1	111.0	110.9
1964	117.3	108.4	102.6	93.4	89.7	115.4	108.1	115.9	115.4
1965	115.7	106.3	101.2	80.4	71.7	92.8	109.5	116.9	116.4
1966	120.3	104.1	101.0	77.5	66.0	84.8	120.7	132.5	132.2
1967	120.3	98.5	93.6	73.6	63.4	83.6	124.1	127.4	137.0
1968	122.2	99.7	91.6	73.1	62.6	82.8	127.1	141.5	141.7

Table 28

	Furniture and fixtures			Saw and planing mills			Pulp and paper mills		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	99.9	98.5		121.0	124.5		117.2	119.2	
1951	108.9	107.0		125.3	127.9		145.0	148.8	
1952	114.6	112.4		118.8	117.8		120.7	119.6	
1953	105.3	99.5		114.7	112.1		118.1	116.7	
1954	113 4	109.7		114.7	112.2		121.3	119.9	
1955	112.3	108.4		119.7	117.7		127.5	126.5	
1956	115.7	112.8		112.1	107.1		123.8	121.3	
1957	120.2	114.5		98.9	90.0		116.0	110.2	
1958	128.7	124.1		102.9	94.9		121.9	115.3	
1959	125.6	118.9		104.1	96.9		123.5	117.9	
1960	124.5	116.5		92.7	83.5		124.5	118.1	
1961	128.6	125.2	100.0	92.2	83.8	100.0	128.2	127.5	100.0
1962	128.8	127.9	101.1	99.5	98.4	116.9	137.8	136.8	106.9
1963	130.0	122.8	98.2	103.2	102.3	120.5	138.4	137.6	107.9
1964	133.7	134.8	107.6	100.3	101.3	117.9	140.5	140.5	110.1
1965	132.9	136.0	108.3	95.7	96.2	111.7	138.6	137.4	107.8
1966	139.7	144.7	114.6	100.8	101.1	118.5	133.0	130.1	101.8
1967	147.2	151.7	119.9	104.0	104.0	122.5	126.6	120.0	94.1
1968	146 7	149.7	118.3	156.8	165.2	186.4	120.3	111.9	88.0

Table 28

	Printing, publishing and allied industries			Iron and steel mills			Agricultural implements		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	99.0	99.1		118.9	121.9		94.3	87.1	
1951	101.5	98.7		143.6	149.7		82.1	68.5	
1952	112.8	110.2		155.8	161.4		105.0	95.0	
1953	117.1	116.7		131.0	129.2		132.5	116.5	
1954	113 4	110.0		184.5	187.2		94.1	52.1	
1955	117.0	114.3		176.8	187.0		108.5	72.7	
1956	120.2	118.3		176.1	187.6		128.8	94.7	
1957	119.3	114.2		190.6	196.3		145.1	115.7	
1958	129.7	127.8		211.6	213.0		102.0	64.8	
1959	128.9	126.3		201.6	209.5		102.8	65.2	
1960	130.5	124.3		186.9	185.1		104.3	44.3	
1961	132.1	126.0	100.0	199.8	203.8	100.0	112.1	51.1	100.0
1962	136.9	132.8	105.2	209.7	216.9	105.2	105.3	51.9	135.3
1963	136.6	129.8	103.1	214.3	223.1	108.1	105.4	74.2	221.0
1964	142.2	139.9	111.2	212.7	222.5	107.9	125.8	99.4	232.2
1965	147.7	144.8	115.3	226.4	240.5	116.3	125.8	101.6	235.1
1966	149.5	145.1	114.8	222.5	230.9	111.2	128.2	102.8	241.7
1967	152.5	146.6	116.8	225.0	226.4	108.6	120.2	87.6	213.0
1968	157.5	151.0	119.8	219.2	223.6	108.1	126.5	85.7	214.2

Table 28

	Motor vehicles			Motor vehicle parts and accessories			Smelting and refining		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0				
1950	133.3	140.1		96.0	97.7				
1951	109.0	112.3		107.2	107.8				
1952	97.5	96.8		114.2	112.9				
1953	83.5	81.1		118.3	115.6				
1954	64.1	52.1		123.9	115.0				
1955	82.3	75.9		123.9	116.7				
1956	84.7	77.7		142.6	139.7				
1957	89.8	80.1		134.6	123.3				
1958	97.1	84.9		138.1	123.3				
1959	138.2	132.9		135.1	125.4				
1960	130.1	122.0		135.7	123.5				
1961	106.4	100.5	100.0	160.8	129.0	100.0	100.0	100.0	100.0
1962	131.5	132.7	116.4	167.9	149.0	123.3	103.3	106.2	104.4
1963	131.9	135.7	116 3	185.0	174.0	146.0	96.4	91.9	95.1
1964	120.9	121.6	106.6	177.9	161.7	127.8	108.4	111.5	111.0
1965	111.9	114.9	106.8	171.5	153.9	123.0	125.3	133.0	131.2
1966	105.1	105 0	99.3	194.5	184.7	154.7	117.3	116.3	117.0
1967	105,4	109.8	108.4	212.9	204.7	173.5	115.7	113.6	115.9
1968	88.1	89.6	104.6	218.1	208.6	174.2	119.3	113.4	114.9

Table 28

	Electrical products			Cement manufacturers			Petroleum and coal products		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	106.2	107.5		105.1	105.0		114.7	114.5	
1951	106.0	99.6		117.4	117.3		126.8	127.7	
1952	117.0	108.4		133.2	132.8		147.0	148.3	
1953	113.2	103.8		138.7	138.8		122.2	121.0	
1954	116.5	102.1		133.0	131.3		212.1	224.2	
1955	102.3	89.1		132.9	130.7		218.2	232.4	
1956	113.2	102.3		128.6	124.9		220.3	234.7	
1957	120.2	102.4		130.5	126.4		235.4	250.8	
1958	111.9	87.5		142.2	136.6		224.9	237.5	
1959	117.0	99.0		146.0	139.0		218.7	230.3	
1960	113.7	94.6		158.7	150.8		261.2	279.6	
1961	111.5	94 3	100.0	175.4	169.1	100.0	253.7	271.8	100.0
1962	112.6	102.0	107.7	177.1	170.8	100.9	227.6	243.6	89.6
1963	108.9	98.8	103.4	185.7	179.4	105.2	212.4	227.7	84.8
1964	109.0	101.2	105.6	188.1	182.1	106.3	211.0	225.5	83.4
1965	106.8	99.3	105.1	188.1	181.8	106.5	185.3	196.4	71.5
1966	106.7	99.4	105.9	192.2	185.5	108.6	184.6	195.4	70.9
1967	104.1	95.4	101.9	201.4	190.8	111.5	193.1	204.2	72.1
1968	106.2	103.5	109.1	214.9	204.0	118.7	209.5	225.2	83.8

Table 28

	Chemicals			All manufacturing		
	Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0	
1950	102.0	100.6		107.7	108.7	
1951	107.8	109.0		115.0	115.7	
1952	107.0	106.8		117.0	115.7	
1953	102.9	101.9		116.6	114.5	
1954	100.4	98.6		119.9	116.3	
1955	105.1	104.7		123.8	121.9	
1956	100.6	98.6		124.0	121.7	
1957	100.9	98.1		126.2	121.2	
1958	106.0	103.6		129.8	123.3	
1959	108.4	106.9		127.1	121.0	
1960	112.9	112.0		129.6	123.1	
1961	111.7	111.7	100.0	131.3	138.7	100.0
1962	111.4	112.2	100.7	139.6	138.6	95.6
1963	111.0	111.6	101.4	131.4	128.7	97.0
1964	105.6	106.9	97.9	132.2	130.8	99.2
1965	105.9	107.2	97.5	133.3	132.2	101.1
1966	105.7	107.5	98.1	135.3	133.4	101.7
1967	105.5	109.8	99.3	136.6	132.8	102.3
1968	105.9	112.6	101.3	138.9	135.1	105.0

Table 29

Unit Residual Cost, 1968/1961, Three Measures Compared

	Based on		
	VA manufacturing		VA total activity
	Production* Labour	Total* Labour	Total labour#
Slaughtering and meat processors	116.5	122.5	127.2
Bakery products	110.4	110.4	113.1
Distilleries	108.1	108.2	108.4
Breweries	109.1	106.9	108.2
Tobacco products	113.1	109.3	110.1
Rubber industries	105.2	108.9	111.7
Cotton yarn and cloth mills	101.7	92.9	91.6
Synthetic textile mills	83.5	82.1	82.8
Clothing industries	125.0	139.0	141.7
Furniture and fixtures	114.3	120.1	118.3
Saw and planing mills	166.2	183.6	186.4
Pulp and paper mills	95.4	89.8	88.0
Printing, publishing & allied industries	119.5	119.7	119.8
Iron and steel mills	112.1	111.9	108.1
Agricultural implements	110.0	119.7	214.2
Motor vehicles	82.8	88.6	104.6
Motor vehicle parts & accessories	166.6	189.6	174.2
Smelting and refining	113.5	111.0	114.9
Electrical products	94.7	107.8	109.1
Cement manufacturers	122.6	120.6	118.7
Petroleum and coal products	79.6	81.2	83.8
Chemicals	94.7	101.4	101.3
All manufacturing	105.7	95.3	105.0

* Columns 1 & 2 based on /49 weights

\# Column 3 based on /61 weights

Source Table 28

Table 30

Unit Residual Cost Indexes, 1968/1949, in Each Industry,
Indexed on the All-Manufacturing Index

	Based on VA manufacturing, relative to	
	Production labour	Total labour
Slaughtering and meat processors	87.3	88.9
Bakery products	102.3	106.2
Distilleries	98.4	101.7
Breweries	100.4	100.9
Tobacco products	94.6	97.1
Rubber industries	83.3	86.8
Cotton yarn and cloth mills	88.0	73.8
Synthetic textile mills	52.6	46.3
Clothing industries	91.5	104.7
Furniture and fixtures	105.6	110.8
Saw and planing mills	112.9	122.3
Pulp and paper mills	86.6	82.8
Printing, publishing & allied industries	113.4	111.8
Iron and steel mills	157.8	165.5
Agricultural implements	91.1	63.4
Motor vehicles	63.4	66.3
Motor vehicle parts and accessories	157.0	154.4
Smelting and refining	—	—
Electrical products	76.5	76.6
Cement manufacturers	154.7	151.0
Petroleum and coal products	150.8	166.7
Chemicals	76.2	83.3

Source Table 28

Table 31

Annual Rate of Change*, Unit Residual Cost

	For 1949-1968 with respect to						For 1961-1968 with respect to								
	Production labour[x]			Total labour[x]			Production labour[x]			Total labour[x]			Total labour[y]		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	0.0	10.5	.008	−0.1	12.8	.032	3.9	8.0	.753	4.6	9.4	.760	5.1	10.7	.763
Bakery products	1.9	5.7	.898	1.7	6.9	.838	2.4	2.9	.887	2.9	2.8	.921	3.2	2.8	.933
Distilleries	1.4	3.5	.924	1.3	3.4	.918	1.3	1.9	.861	1.4	2.1	.843	1.5	2.2	.847
Breweries	1.4	3.3	.937	1.3	3.6	.911	1.3	2.0	.840	0.9	2.2	.720	1.0	2.2	.739
Tobacco products	1.3	9.8	.597	1.4	10.4	.622	4.8	5.8	.872	4.7	7.0	.826	4.3	5.5	.865
Rubber industries	−1.6	12.8	.709	−1.8	14.1	.724	6.2	1.3	.992	5.6	3.9	.941	5.5	3.8	.945
Cotton yarn and cloth mills	2.1	9.2	.769	1.9	13.6	.548	−0.6	3.9	.342	−2.3	4.1	.823	−2.1	4.0	.800
Synthetic textile mills	−0.8	10.4	.351	−1.0	14.5	.312	−4.3	6.1	.882	−5.2	8.7	.858	−5.3	8.4	.863
Clothing industries	1.1	8.9	.795	2.2	8.0	.823	5.3	10.2	.761	5.0	4.0	.951	6.0	3.5	.973
Furniture and fixtures	2.2	3.6	.964	2.7	5.4	.944	2.6	2.0	.951	3.9	3.4	.937	3.6	2.9	.947
Saw and planing mills	−0.4	15.4	.187	−0.4	19.2	.107	6.7	18.6	.638	7.6	21.3	.654	7.2	22.2	.631
Pulp and paper mills	0.5	10.6	.315	0.2	10.9	.122	−1.7	3.0	.842	2.6	4.2	.854	−2.9	4.7	.858
Printing, publishing & allied industries	2.8	3.0	.985	2.3	3.9	.971	2.7	1.2	.981	2.5	2.3	.936	2.6	2.3	.936
Iron and steel mills	3.6	14.1	.907	3.7	15.9	.892	0.7	3.7	.496	0.1	6.4	.057	0.5	3.7	.284
Agricultural implements	1.3	14.9	.449	0.1	22.9	.159	2.5	5.0	.759	2.9	8.3	.670	4.4	34.3	.493
Motor vehicles	9.5	26.2	.224	1.2	24.3	.249	−5.3	4.0	.968	−5.1	5.2	.952	−1.8	4.6	.730
Motor vehicle parts and accessories	6.3	9.8	.963	5.7	14.2	.907	4.8	6.6	.872	6.3	10.7	.848	6.9	14.4	.809
Smelting and refining	—	—	—	—	—	—	3.1	5.4	.799	2.8	6.3	.721	2.7	10.3	.543
Electrical products	−0.3	4.9	.306	−0.2	5.4	.247	−1.1	1.2	.906	−0.1	2.6	.152	0.1	2.7	.047
Cement manufacturers	5.1	8.7	.964	4.5	9.3	.950	2.9	2.7	.930	2.6	2.4	.932	2.4	2.2	.937
Petroleum and coal products	2.2	38.5	.483	2.6	43.3	.504	−2.6	5.8	.666	−2.6	7.3	.592	−2.3	7.0	.553
Chemicals	0.2	3.6	.355	0.5	4.0	.596	−0.9	1.5	.810	0.0	2.4	.012	−0.1	1.8	.101
All manufacturing	1.3	3.1	.938	1.2	4.2	.888	0.2	2.6	.206	−0.1	2.6	.176	1.6	0.6	.984

*percentage rate S — standard estimate of error R — goodness of fit ratio

x — The measures thus marked have been computed in relation to value added by manufacturing activity

y — The measures thus marked have been computed in relation to value added by total activity

The measures covering 1949 to 1968 are based on 1949 weights (ratio of labour compensation, or payroll, to value added) and those covering 1961 to 1968 use 1961 weights.

Source computed from data in Table 28

The indexes for 1968 over 1949 and 1968 over 1961 have been averaged for the industries covered by this study and appear as part of Table 32. Over both the full and short periods unit residual cost increased about as much whether related to production or total labour. The average indexes for 1968/1949 are 141.8 and 139.1 relative to production and total labour respectively and for 1968/1961 they are 111.1 and 114.8, all relative to value added by manufacturing. For all manufacturing (see Table 33) the indexes for 1968/1949 are 138.9 and 135.1 with respect to production and total labour respectively, while for 1968/1961 they are 105.8 and 98.8. The index related to production labour showed a greater increase in each case because unit labour cost for total labour increased more than for production labour, the indexes for 1968/1949 being 123.0 and 130.8 and for 1968/1961, 106.9 and 117.6.

Interindustry variation among the covered industries (as indicated by the coefficient of variation), was greater for unit residual cost than for unit labour cost except with respect to production labour for 1968/1949. This can be seen in Table 32. To repeat the kind of analysis applied in the previous chapter to unit labour cost, the relative indexes (1968/1949) of unit residual cost (relative, that is, to the index for all manufacturing) are distributed as follows (based on data in Table 30):

Index range	In relation to Production labour	Total labour
	(number of industries)	
less than 50	1	2
51–75	2	3
76–100	10	6
101–125	5	7
126–150	0	0
151–175	4	4

While there is a clustering of the indexes around 100, which represents the all-manufacturing average, they also occupy a wide enough range to demonstrate the great variation of industry experience with unit residual cost, as is the case also with unit labour cost. Changes between 1949 and 1968 in unit residual cost (as indicated by the indexes in Table 28) range from a high of + 119.2 percent for iron and steel mills to a low of -26.9 percent for synthetic textiles, both with respect to production labour only; and, over the same period, from a high of + 125.2 percent for petroleum and coal products to a low of -37.4 percent also for synthetic textiles, both with respect to total labour employed. (All of these measures are derived from data on value added by manufacturing.)

Since unit residual cost change is computed as a residual item after allowing for unit labour cost, it might be expected that the two measures would move in opposite directions and that the stronger the upward move in one the stronger the downward move in the other. This does not necessarily follow because the relation of these measures depends partly on the weight of each (that is, the outlay for each as a proportion of value added) and even more on the behaviour of implicit price over the period.

Based on what we have already observed from the index numbers, it is to be expected that the annual trend rate of change in unit residual cost, for the 1949-1968 period, should be greater with respect to production labour only than with respect to total labour; for all manufacturing the rates are 1.3 percent and 1.2 percent respectively. It has already been explained that this is because of the higher rate of increase of that part of unit labour cost based on nonproduction labour compared with that based on production labour, and that nonproduction labour is part of unit residual cost when only production labour has been removed in computing the residual.

The trend rates for the industries appear in Table 31; averages of the rates for the covered industries appear in Table 32. The 1949-1968 rates are similar in both tables, but the averages for the covered industries are markedly different from those for all manufacturing with respect to the rates for 1961-1968. However, the differences may be more statistical than real because the Table 32 averages are unweighted while the rates shown for all manufacturing reflect the combined effect of rates of change in all manufacturing industries, the influence of each industry on the total being proportional to its importance in the industrial structure, which is tantamount to a weighted average of the individual industry rates.

Aside from the data for 1961-1968 related to value added by total activity, there is a considerable difference between rates for all manufacturing for the entire period and for the more recent period. Rates of increase for the full period become rates of virtually no change for 1961-1968. With respect to production labour, for the full period there was a highly significant (statistically) annual trend rate of increase of 1.3 percent; over the recent period there was a trend rate of increase of 0.2 percent, small enough in itself, but not statistically significant in any event (R = .206). In effect, it meant no net change over the 1961-1968 period. It can be seen from Table 33 and elsewhere that a similar condition applied with respect to total labour as well.

We observe from Table 31 that , with respect to production labour, the following industries had negative rates of change for the time periods indicated:

1949-1968	1961-1968
Rubber industries	_____
_____	cotton yarn and cloth mills
Synthetic textiles	Synthetic textiles
Saw and planing mills	_____
_____	Pulp and paper mills
_____	Motor vehicles
Electrical products	Electrical products
_____	Petroleum and coal products
_____	Chemicals

It should be added that slaughtering and meat processors showed a zero rate of change for the 1949-1968 period although there was a rate of increase of 3.9 percent per annum for the more recent period. Only two industries, synthetic textiles and electrical products, showed a rate of decline in both periods, which illustrates how unit residual cost changed with the passage of time and varied from one industry to another. Seven industries changed from increasing to decreasing unit residual cost, or vice-versa, between the 1950's and the 1960's.

The erratic behaviour of unit residual cost, the lack of any clear trend, is indicated by the low R values for many industries in Table 31. If R is to be significant at the 95 percent level, it must have a value of at least .388 and at the 99 percent level, of at least .529.[6] The R values for many industries fell below one or both of these values, as indicated in the following:

In relation to	R values of less than .388 (number of industries)	.529
production labour (1949-1968)[x]	7	9
total labour (1949-1968)[x]	7	8
production labour (1961-1968)[x]	2	3
total labour (1961-1968)[x]	4	4
total labour (1961-1968)[y]	3	4

x - with respect to value added, manufacturing
y - with respect to value added, total activity

The number of statistically insignificant R values is much less for the more recent period. The average R values for the covered industries, along with the usual measures of dispersion, appear in Table 32.

Of course, R values of .388 and .529, while statistically significant, still leave much to be explained in terms of other than the mere passage of time. For example, in Table 31, the annual trend rate for unit residual cost for slaughtering and meat processors is 3.9 percent, the standard error is 8.0 and the R is .753; it is therefore significant at the 99 percent level. This means that for 1965 the index is 115.6 (1961 being 100) on the basis of the trend rate with a 99 percent likelihood that the actual index is within one standard error of that value; in other words, between 107.6 and 123.6. Considering this as percentage change from the base year, the range is between 7.6 and 23.6 percent, a considerable difference. To follow the analysis introduced in Chapter Seven, if we square the R of .753, it means that 56.7 percent of the change in unit residual cost in that industry can be associated with the passage of time. Put another way, it can be said that somewhat more than half of the change is influenced by factors (whatever they may be) that operate in a pattern that is coincident with the passage of time (at least, when time is measured in units of years), while the rest of the change must be attributed to factors whose influence is erratic, at least in relation to time.

Where the R value is .800, 64 percent of change can be associated with time, if it is .850, the percentage is 72.25, if it is .900, 81 percent, if .950, 90 percent, and so on. Where a trend rate has a low R value, that is, shows a poor fit, it means that either the trend follows a nonlinear pattern (which is considered in part in Appendix C), or while there is some evidence of a straight-line trend, it is subject to many erratic fluctuations, or there is little or no trend at all.

Table 32

Averages of Values for the Covered Manufacturing Industries

		M	σ	V (%)
Compensation per worker				
A	Indexes			
	Production labour 1968/1949	261.9	26.9	10.3
	Total labour 1968/1949	259.4	28.8	11.1
	Production labour 1968/1949	142.6	6.5	4.5
	Total labour 1968/1961	141.2	8.4	6.0
B	Annual trend rates			
	Production labour 1949-1968	7.4	1.3	17.8
	Total labour 1949-1968	7.6	1.4	17.8
	Production labour 1961-1968	5.9	1.0	16.5
	Total labour 1961-1968	5.9	1.1	19.2
C	R values related to trend rates			
	Production labour 1949-1968	.982	.012	1.2
	Total labour 1949-1968	.988	.005	0.5
	Production labour 1961-1968	.962	.057	5.9
	Total labour 1961-1968	.976	.023	2.4
Output per worker				
A	Indexes			
	Production labour 1968/1949	242.3	74.7	30.8
	Total labour 1968/1949	223.8	67.6	30.2
	Production labour 1968/1961	136.0	20.3	15.0
	Total labour 1968/1961	137.3	23.6	17.2
B	Annual trend rates			
	Production labour 1949-1968	8.8	6.3	71.1
	Total labour 1949-1968	7.6	4.7	62.6
	Production labour 1961-1968	4.1	3.4	82.9
	Total labour 1961-1968	4.1	3.6	87.8
C	R values related to trend rates			
	Production labour 1949-1968	.943	.103	10.9
	Total labour 1949-1968	.927	.133	14.3
	Production labour 1961-1968	.820	.180	22.0
	Total labour 1961-1968	.815	.212	26.0

Table 32

		M	σ	V (%)
Unit labour cost				
A	Indexes			
	Production labour 1968/1949	120.3	38.0	31.6
	Total labour 1968/1949	128.6	39.2	30.5
	Production labour 1968/1961	106.7	14.6	13.7
	Total labour 1968/1961	105.1	16.0	15.2
B	Annual trend rates			
	Production labour 1949-1968	.2	2.0	804.5
	Total labour 1949-1968	.6	1.9	313.4
	Production labour 1961-1968	1.8	2.3	127.8
	Total labour 1961-1968	1.9	2.6	136.8
C	R values related to trend rates			
	Production labour 1949-1968	.627	.316	50.4
	Total labour 1949-1968	.592	.330	55.7
	Production labour 1961-1968	.646	.243	37.6
	Total labour 1961-1968	.698	.255	36.5
Unit residual cost				
A	Indexes			
	Production labour 1968/1949^{x}	141.8	41.3	29.1
	Total labour 1968/1949^{x}	139.1	44.4	31.9
	Production labour 1968/1961^{x}	111.1	21.9	19.7
	Total labour 1968/1961^{x}	114.8	27.2	23.7
	Total labour 1968/1961^{y}	119.8	32.8	27.4
B	Annual trend rates			
	Production labour 1968/1949^{x}	1.5	1.9	127.7
	Total labour 1968/1949^{x}	1.4	1.8	125.5
	Production labour 1968/1961^{x}	1.6	3.3	206.3
	Total labour 1968/1961^{x}	1.6	3.5	218.8
	Total labour 1968/1961^{y}	1.9	3.4	178.9
C	R values related to trend rates			
	Production labour 1949/1968^{x}	.622	.314	50.5
	Total labour 1949/1968^{x}	.585	.328	56.1
	Production labour 1961/1968	.810	.159	19.6
	Total labour 1961/1968^{x}	.727	.287	39.5
	Total labour 1961/1968^{y}	.709	.271	38.2

Table 32

		M	σ	V (%)
Implicit (value-added) price				
A	Indexes by			
	Value added, manufacturing 1968/1949	135.0	33.9	25.1
	Value added, manufacturing 1968/1961	109.3	16.0	15.0
	Value added, total activity 1968/1961	109.2	12.7	11.7
B	Annual trend rates by			
	Value added, manufacturing 1949-1968	1.3	1.7	134.8
	Value added, manufacturing 1961-1968	1.6	2.6	159.2
	Value added, total activity 1961-1968	1.8	2.2	124.6
C	R values, related to trend rates			
	Value added, manufacturing 1949-1968	.639	.312	48.8
	Value added, manufacturing 1961-1968	.790	.169	21.4
	Value added, total activity 1961-1968	.800	.182	22.7
Change in labour share				
A	Indexes			
	Production labour 1968/1949[x]	90.0	20.0	22.3
	Total labour 1968/1949[x]	96.0	18.7	19.5
	Production labour 1968/1961[x]	98.3	11.1	11.3
	Total labour 1968/1961[x]	96.7	11.7	12.1
	Total labour 1968/1961[y]	96.4	11.7	12.2
B	Annual trend rates			
	Production labour 1949-1968[x]	− .7	1.2	179.6
	Total labour 1949-1968[x]	− .1	1.1	1231.7
	Production labour 1961-1968[x]	.3	2.0	658.1
	Total labour 1961-1968[x]	.3	2.0	629.0
	Total labour 1961-1968[y]	.2	2.0	1079.0
C	R values, related to trend rates			
	Production labour 1949-1968[x]	.668	.231	34.6
	Total labour 1949-1968[x]	.541	.256	47.3
	Production labour 1961-1968[x]	.580	.305	52.6
	Total labour 1961-1968[x]	.568	.242	42.6
	Total labour 1961-1968[y]	.594	.223	37.5

Table 32

		M	σ	V (%)
Change in residual share				
A	Indexes			
	Production labour 1968/1949[x]	104.6	10.5	10.1
	Total labour 1968/1949[x]	102.1	15.4	15.1
	Production labour 1968/1961[x]	101.1	6.3	6.2
	Total labour 1968/1961[x]	104.2	11.4	10.9
	Total labour 1968/1961[y]	108.8	23.1	21.3
B	Annual trend rates			
	Production labour 1949-1968[x]	.3	.6	201.0
	Total labour 1949-1968[x]	.3	.6	253.6
	Production labour 1961-1968[x]	– .1	1.0	927.3
	Total labour 1961-1968[x]	– .1	1.5	1208.3
	Total labour 1961-1968[y]	.1	1.7	1537.3
C	R values related to trend rates			
	Production labour 1949-1968[x]	.668	.231	34.6
	Total labour 1949-1968[x]	.541	.256	47.3
	Production labour 1961-1968[x]	.581	.304	52.3
	Total labour 1961-1968[x]	.567	.241	42.5
	Total labour 1961-1968[x]	.592	.223	37.7
Unit Residual Cost One year lagged Moving Weights				
A	Indexes			
	Production labour 1968/1949[x]	137.6	37.9	27.5
	Total labour 1968/1949[x]	132.7	44.4	33.4
	Production labour 1968/1961[x]	111.0	21.8	19.6
	Total labour 1968/1961[x]	114.7	28.4	24.7
	Total labour 1968/1961[y]	114.2	24.3	21.3
B	Annual trend rates			
	Production labour 1949-1968[x]	1.3	1.8	136.6
	Total labour 1949-1968[x]	.8	3.1	372.6
	Production labour 1961-1968[x]	1.6	3.2	202.5
	Total labour 1961-1968[x]	1.3	3.5	276.8
	Total labour 1961-1968[y]	1.4	3.3	239.4
C	R values related to trend rates			
	Production labour 1949-1968[x]	.527	.312	56.0
	Total labour 1949-1968[x]	.558	.334	59.9
	Production labour 1961-1968[x]	.800	.179	22.4
	Total labour 1961-1968[x]	.707	.259	36.6
	Total labour 1961-1968[y]	.710	.269	37.9

[x]Related to value added manufacturing

[y]Related to value added total activity

Table 33

Summary of Values for Total Manufacturing

Compensation per worker

A	Indexes	
	Production labour, 1968/1949	261.5
	Total labour, 1968/1949	266.5
	Production labour, 1968/1961	143.9
	Total labour, 1968/1961	145.9
B	Annual trend rates	
	Production labour, 1949-1968	7.2%
	Total labour, 1949-1968	7.5%
	Production labour, 1961-1968	6.3%
	Total labour, 1961-1968	6.3%
C	R values related to trend rates	
	Production labour, 1949-1968	.988
	Total labour, 1949-1968	.990
	Production labour, 1961-1968	.989
	Total labour, 1961-1968	.987

Output per worker

A	Indexes	
	Production labour, 1968/1949	212.7
	Total labour, 1968/1949	203.7
	Production labour, 1968/1961	134.6
	Total labour, 1968/1961	124.1
B	Annual trend rates	
	Production labour, 1949-1968	5.9%
	Total labour, 1949-1968	5.8%
	Production labour, 1961-1968	3.7%
	Total labour, 1961-1968	3.9%
C	R values related to trend rates	
	Production labour, 1949-1968	.995
	Total labour, 1949-1968	.990
	Production labour, 1961-1968	.987
	Total labour, 1961-1968	.989

Unit labour cost

A	Indexes	
	Production labour, 1968/1949	123.0
	Total labour, 1968/1949	130.8
	Production labour, 1968/1961	106.9
	Total labour, 1968/1961	117.6
B	Annual trend rates	
	Production labour, 1949-1968	0.5%
	Total labour, 1949-1968	0.7%
	Production labour, 1961-1968	2.0%
	Total labour, 1961-1968	1.9%
C	R values related to trend rates	
	Production labour, 1949-1968	.615
	Total labour, 1949-1968	.668
	Production labour, 1961-1968	.958
	Total labour, 1961-1968	.910

Unit residual cost

A	Indexes	
	Production labour, 1968/1949^{x}	138.9
	Total labour, 1968/1949^{x}	135.1
	Production labour, 1968/1961^{x}	105.8
	Total labour, 1968/1961^{x}	98.8
	Total labour, 1968/1961^{y}	105.0
B	Annual trend rates	
	Production labour, 1949-1968^{x}	1.3%
	Total labour, 1949-1968^{x}	1.2%
	Production labour, 1961-1968^{x}	0.2%
	Total labour, 1961-1968^{x}	−0.1%
	Total labour, 1961-1968^{y}	1.6%
C	R values related to trend rates	
	Production labour, 1949-1968^{x}	.938
	Total labour, 1949-1968^{x}	.888
	Production labour, 1961-1968^{x}	.206
	Total labour, 1961-1968^{x}	.176
	Total labour, 1961-1968^{y}	.984

(x — related to value added, manufacturing; y — related to value added, total activity)

Table 33

Implicit (value-added) price

A	Indexes, by	
	Value added, manufacturing, 1968/1949	133.0
	Value added, manufacturing, 1968/1961	106.2
	Value added, total activity, 1968/1961	110.5
B	Annual trend rates, by	
	Value added, manufacturing, 1949-1968	1.0
	Value added, manufacturing, 1961-1968	0.9
	Value added, total activity, 1961-1968	1.7
C	R values related to trend rates,	
	Value added, manufacturing, 1949-1968	.913
	Value added, manufacturing, 1961-1968	.705
	Value added, total activity, 1961-1968	.984

The number of industries for which R is less than .800 is shown in the following table not only for unit residual cost but also for output per worker and unit labour cost, so that an immediate comparison can be made. For several industries R is between .700 and .800, suggesting a definite but weak trend, so that the number of these industries is shown in brackets beside the larger number. The breakdown is as follows:

	output per worker	unit labour cost	unit residual cost
Production labour, 1949–68	1 (0)	12 (3)	14 (3)
Total labour, 1949–68	1 (0)	12 (1)	12 (1)
Production labour, 1961–68	6 (2)	16 (5)	8 (4)
Total labour, 1961–68	6 (1)	12 (2)	9 (3)x
Total labour, 1961–68	-	-	10 (3)y

(x and y as specified in Table 31)

With respect to both unit cost series there is far less evidence of a steady longrun trend than there is for output per worker.[7] This is also apparent from Table 32 and a comparison of the average R values for the same three measures. Admittedly, the unit residual cost measures exhibit some seemingly strange behaviour that this study cannot explain. Why should the number of R values below .800 for unit residual cost be so much less for the third and fourth series than for the first two, especially when similar behaviour is not found in the unit labour cost series? Why, also, should the R values for all manufacturing unit residual cost (Table 31) for the third and fourth series be so low as to be statistically insignificant when the other three R's are quite high? This seems especially strange when the table above shows that for these two series there were fewer R's of less than .800 than for the other series.

The only explanation that can be offered is to repeat the point made concerning unit labour cost, which is that both unit cost series reflect the influence of a variety of highly volatile factors. On the other hand, compensation and output per worker follow a much smoother trend line.

Unit costs and implicit price

The index of implicit (value-added) price is the sum of the weighted indexes of unit labour cost and unit residual cost, the weights being the proportion of value added accounted for by the outlay for labour and residual inputs. It is expressed as follows:[8]

$$\frac{W}{Y}\left(\frac{w}{va}\right)_0 + \frac{R}{Y}\left(1 - \frac{w}{va}\right)_0 = \frac{VA}{Y}$$

With the information present in this and the preceding chapter, and using the appropriate weights, we can at once see the relation between each type of unit cost and implicit price behaviour.

Table 34 contains the data on the proportion of payroll to value added.[9] The proportions are given for each year along with index numbers so that changes from year to year can easily be discerned. However, for the present purpose all that is needed is the proportion for the base year since the unit cost measures are base-weighted.

To use an example, the weight to be assigned the unit labour cost index with respect to production labour in the slaughtering and meat processing industry is .353, which is the proportion shown in Table 34 for 1949. The unit residual cost weight is, by subtraction, .647. Using these weights and data already presented, the composition of the implicit price index for the industry in 1968 is as follows:

147.1	(.353)	+	121.3	(.647)	=	130.4
(24)	(34)		(28)			(12)

(The bracketed numbers refer to the tables from which the data were obtained.)

This means that by 1968, compared with 1949, unit production labour costs had risen 47.1 percent and unit residual costs 21.3 percent; since unit labour cost in the base year constituted only slightly more than one-third of total unit cost, notwithstanding that labour cost rose more than twice as much as residual cost, implicit price rose far less than the rise in unit labour cost but by more than unit residual cost.

If the trend rates for unit labour cost and unit residual cost, duly weighted, are added, the result should closely approximate the trend rate of change for implicit price but may not be identical with it, as it should be when index numbers are added in this way. (This is because of rounding, smoothing and possibly conflicting trend movements; see Appendix B.) To continue with slaughtering and meat processors as our example, with respect to production labour and value added by manufacturing, there is a zero trend rate for unit residual cost. While the base-weighted index for 1968 over 1949, as shown above, is 121.3, it was 132.6 in 1967, 122.5 in 1966 and 101.9 in 1965 while even back in 1952 it was 128.3; because of such erratic fluctuations, there is no trend. The composition of the trend rate of change (production labour, value added by manufacturing, for 1949-1968) is as follows:

0.9	(.353)	+	0	(.647)	=	0.3
(26)	(34)		(31)			(16)

(The bracketed numbers refer to the tables from which the data were obtained.)

The first figure refers, of course, to the trend rate for unit labour cost, followed by its weight, followed by the trend for unit residual cost and its weight.

While, in this case, all of the longrun increase in implicit price is composed of only a labour cost component, in any given year some of the change (relative to 1949, the base year) is composed of residual cost. In 1968, when implicit price showed an increase over 1949 of 30.4 percent, 54.6 percent of the increase was made up of unit labour cost and 45.4 percent, of unit residual cost; but in 1965, 83.6 percent of the increase consisted of unit labour cost and 16.4 percent of unit residual cost.[10]

Slaughtering and meat processors is the only industry (with respect to the 1949-1968 production labour, value added, manufacturing series) with a zero rate of change for unit residual cost and its cost and implicit price indexes follow an erratic path. But there is a significant trend for unit labour cost ($R = .552$) and for an understanding of any underlying movements in costs and prices over the period studied, it is the trend values, not the index numbers, that should be studied.[11] However, adding trend values in an equation is subject to hazards that do not arise in adding index numbers. The latter refer to the situation in a given year and can be accepted as entirely accurate, but trend rates are averages that represent the actual change in a given year more or less accurately depending on how good a statistical fit can be obtained from the trend values. If one or both trend rates for unit labour and unit residual cost have a poor fit, combining them according to our equation may produce a less than perfect trend rate for implicit (value-added) price.[12]

Changes in factor shares

When one unit cost index moves up more than the other, or moves down less (or, for that matter, moves up while the other moves down), the payments to that factor, be it labour or the residual, will increase relative to the other.[13] That is, there will be a change in factor shares.

Table 34

Payroll as a Proportion of Value Added

	Slaughtering and meat processors					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.353	100.0	.482	100.0		
1950	.369	104.5	.506	105.0		
1951	.376	106.5	.515	106.8		
1952	.338	95.8	.450	93.4		
1953	.360	102.0	.490	101.7		
1954	.360	102.0	.499	103.5		
1955	.341	96.6	.465	96.5		
1956	.391	110.8	.528	109.5		
1957	.382	108.2	.520	107.9		
1958	.386	109.3	.523	108.5		
1959	.390	110.5	.521	108.1		
1960	.405	114.7	.547	113.5		
1961	.422	119.5	.575	119.3	.602	100.0
1962	.396	112.2	.537	111.4	.562	93.4
1963	.398	112.7	.534	110.8	.559	92.9
1964	.386	109.3	.518	107.5	.539	89.5
1965	.386	109.3	.528	109.5	.545	90.5
1966	.374	105.9	.508	105.4	.530	88.0
1967	.372	105.4	.486	100.8	.508	84.4
1968	.398	112.7	.524	108.7	.551	91.5

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Source D.B.S.: *Manufacturing Industries of Canada,* Section A (Catalogue No. 31-203)

Table 34

	Bakery products					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.444	100.0	.545	100.0		
1950	.440	99.1	.537	98.5		
1951	.426	95.9	.518	95.0		
1952	.425	95.7	.516	94.7		
1953	.437	98.4	.529	97.1		
1954	.459	103.4	.557	102.2		
1955	.467	105.2	.561	102.9		
1956	.482	108.6	.578	106.1		
1957	.474	106.8	.572	105.0		
1958	.476	107.2	.574	105.3		
1959	.480	108.1	.578	106.1		
1960	.482	108.6	.586	107.5		
1961	.463	104.3	.557	102.2	.569	100.0
1962	.465	104.7	.571	104.8	.581	102.1
1963	.472	106.3	.575	105.5	.585	102.8
1964	.467	105.2	.567	104.0	.576	101.2
1965	.465	104.7	.570	104.6	.577	101.4
1966	.480	108.1	.575	105.5	.583	102.5
1967	.490	110.4	.580	106.4	.590	103.7
1968	.493	111.0	.581	106.6	.586	103.0

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Distilleries					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.141	100.0	.210	100.0		
1950	.126	89.4	.187	88.6		
1951	.132	93.6	.190	90.0		
1952	.141	100.0	.200	94.8		
1953	.145	102.8	.201	95.3		
1954	.145	102.8	.197	93.4		
1955	.153	108.5	.204	96.7		
1956	.157	111.3	.206	97.6		
1957	.149	105.7	.202	95.7		
1958	.142	100.7	.195	92.4		
1959	.133	94.3	.189	89.6		
1960	.121	85.8	.180	85.3		
1961	.117	83.0	.187	88.6	.191	100.0
1962	.111	78.7	.184	87.2	.188	98.4
1963	.099	70.2	.168	79.6	.172	90.1
1964	.094	67.7	.159	75.4	.163	85.3
1965	.099	70.2	.168	79.6	.172	90.1
1966	.094	66.7	.159	75.4	.163	85.3
1967	.096	68.1	.163	77.3	.166	86.9
1968	.093	66.0	.163	77.3	.166	86.9

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity.

Table 34

	Breweries					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.170	100.0	.230	100.0		
1950	.160	94.1	.227	98.7		
1951	.172	101.2	.244	106.1		
1952	.174	102.4	.238	103.5		
1953	.159	93.5	.216	93.9		
1954	.162	95.3	.226	98.3		
1955	.153	90.0	.217	94.3		
1956	.158	92.9	.228	99.1		
1957	.153	90.0	.218	94.8		
1958	.152	89.4	.219	95.2		
1959	.153	90.0	.220	95.7		
1960	.150	88.2	.222	96.5		
1961	.139	81.8	.206	89.6	.217	100.0
1962	.132	77.6	.202	87.8	.210	96.8
1963	.126	74.1	.199	86.5	.207	95.4
1964	.122	71.8	.197	85.7	.205	94.5
1965	.130	76.5	.211	91.7	.220	101.4
1966	.128	75.3	.210	91.3	.220	101.4
1967	.127	74.7	.209	90.9	.217	100.0
1968	.130	76.5	.212	92.2	.221	101.8

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Tobacco products					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.297	100.0	.374	100.0		
1950	.272	91.6	.347	92.8		
1951	.322	108.4	.414	110.7		
1952	.281	94.6	.359	96.0		
1953	.282	94.9	.357	95.5		
1954	.281	94.6	.351	93.9		
1955	.267	89.9	.332	88.8		
1956	.274	92.3	.343	91.7		
1957	.300	101.0	.377	100.8		
1958	.296	99.7	.376	100.5		
1959	.266	89.6	.341	91.2		
1960	.249	83.8	.325	89.9		
1961	.230	77.4	.299	79.9	.305	100.0
1962	.246	82.8	.327	87.4	.335	109.8
1963	.245	82.5	.311	83.2	.316	103.6
1964	.245	82.5	.316	84.5	.318	104.3
1965	.216	72.7	.278	74.3	.284	93.1
1966	.211	71.0	.273	73.0	.279	91.5
1967	.213	71.7	.284	75.9	.290	95.1
1968	.241	81.1	.326	87.2	.334	109.5

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Rubber industries					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.339	100.0	.474	100.0		
1950	.296	87.3	.405	85.4		
1951	.289	85.3	.399	84.2		
1952	.286	84.4	.403	85.0		
1953	.294	86.7	.411	86.7		
1954	.318	93.8	.453	95.6		
1955	.283	83.5	.394	83 1		
1956	.296	87.3	.414	87.3		
1957	.329	97.1	.471	99.4		
1958	.298	87.9	.437	92.2		
1959	.321	94.7	.462	97.5		
1960	.342	100.9	.500	105.5		
1961	.346	102.1	.492	103.8	.470	100.0
1962	.375	110.6	.453	95.6	.478	101.7
1963	.377	111.2	.504	106.3	.470	100.0
1964	.371	109.4	.503	106.1	.475	101.0
1965	.355	104.7	.484	102.1	.457	97.2
1966	.344	101.2	.460	97.0	.431	91.7
1967	.325	95.9	.447	94.3	.422	89.6
1968	.314	92.6	.446	94.1	.419	89.1

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Cotton yarn and cloth mills					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.520	100.0	.594	100.0		
1950	.503	96.7	.579	97.5		
1951	.519	99.8	.605	101.9		
1952	.566	108.8	.680	114.5		
1953	.625	120.2	.751	126.4		
1954	.572	110.0	.699	117.7		
1955	.576	110.8	.730	122.9		
1956	.530	101.9	.681	114.6		
1957	.506	97.3	.659	110.9		
1958	.495	95.2	.672	113.1		
1959	.475	91.3	.636	107.1		
1960	.466	89.6	.615	103 5		
1961	.449	86.3	.583	98.1	.579	100.0
1962	.448	86 2	.578	97.3	.575	99.3
1963	.423	81.3	.547	92.1	.546	94.3
1964	.448	86.2	.569	95.8	.563	97.2
1965	.454	87.3	.576	97.0	.569	98.3
1966	.466	89.6	.610	102.7	.598	103.3
1967	.491	94.4	.648	109.1	.642	110.9
1968	.466	89.6	.632	106.4	.633	109.3

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Synthetic textile mills					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.368	100.0	.478	100.0		
1950	.336	91.3	.457	95.6		
1951	.342	92.9	.463	96.9		
1952	.331	89.9	.475	99.4		
1953	.396	107.6	.559	116.9		
1954	.383	104.1	.581	121.5		
1955	.361	98.1	.545	114.0		
1956	.402	109.2	.617	129.1		
1957	.390	106.0	.598	125.1		
1958	.359	97.6	.567	118.6		
1959	.315	85.6	.499	104.4		
1960	.314	85.3	.486	101.7		
1961	.294	79.9	.480	100.4	.495	100.0
1962	.281	76.4	.452	94.6	.466	94.1
1963	.272	73 9	.426	89.1	.442	88.3
1964	.278	75.5	.427	89.3	.446	90.1
1965	.323	87.8	.502	105.0	.520	105.1
1966	.335	91.0	.532	111.3	.552	111.5
1967	.339	92.1	.529	110.7	.542	109.5
1968	.331	89.9	.527	110.3	.540	109.1

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Clothing industries					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.442	100.0	.589	100.0		
1950	.448	101.4	.603	102.4		
1951	.452	102.3	.604	102.5		
1952	.450	101.8	.590	100.2		
1953	.465	105.2	.606	102.9		
1954	.473	107.0	.622	105.6		
1955	.463	104.8	.607	103.1		
1956	.474	107.2	.617	104.8		
1957	.469	106.1	.621	105.4		
1958	.465	105.2	.614	104.2		
1959	.466	105.4	.611	103.7		
1960	.462	104.5	.617	104.8		
1961	.476	107.5	.618	104.9	.629	100.0
1962	.478	108.1	.602	102.2	.613	97.5
1963	.475	107.5	.591	100.3	.601	95.5
1964	.481	108.8	.590	100.2	.600	95.4
1965	.483	109.3	.593	100.7	.603	95.9
1966	.474	107.2	.574	97.5	.584	92.8
1967	.483	109.3	.599	101.7	.591	94.0
1968	.484	109.5	.577	98.0	.586	93.2

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Furniture and fixtures					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.491	100.0	.626	100.0		
1950	.488	99.4	.629	100.5		
1951	.477	97.1	.622	99.4		
1952	.470	95.7	.618	98.7		
1953	.501	102.0	.654	104.5		
1954	.483	98.4	.633	101.1		
1955	.482	98.2	.633	101.1		
1956	.480	97.8	.628	100.3		
1957	.480	97.8	.636	101.6		
1958	.464	94.5	.620	99.0		
1959	.471	95.9	.632	101.0		
1960	.472	96.1	.637	101.8		
1961	.452	92.1	.609	97.3	.589	100.0
1962	.456	92.9	.603	96.3	.586	99.5
1963	.454	92.5	.622	99.4	.602	102.2
1964	.456	92.9	.597	95.4	.578	98.1
1965	.452	92.1	.588	93.9	.569	96.6
1966	.447	91.0	.579	92.5	.562	95.4
1967	.442	90.0	.577	92.2	.560	95.1
1968	.447	91.0	.586	93.6	.569	96.6

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Saw and planing mills					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.451	100.0	.543	100.0		
1950	.408	90.5	.494	91.0		
1951	.424	94.0	.511	94.1		
1952	.443	98.2	.541	99.6		
1953	.448	99.3	.551	101.5		
1954	.447	99.1	.550	101.3		
1955	.433	96.0	.536	98.7		
1956	.454	100.7	.566	104.2		
1957	.490	108.6	.615	113.3		
1958	.478	106.0	.599	110.3		
1959	.465	103.1	.586	107.9		
1960	.494	109.5	.621	114.4		
1961	.493	109.3	.617	113.6	.632	100.0
1962	.464	102.9	.560	103.1	.576	91.1
1963	.450	99.8	.547	100.7	.565	89.4
1964	.452	100.2	.540	99.4	.561	88.8
1965	.474	105.1	.560	103.1	.582	92.1
1966	.482	106.9	.567	104.4	.587	92.9
1967	.484	107.3	.571	105.2	.589	93.2
1968	.408	90.5	.481	88.6	.511	80.9

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Pulp and paper mills					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.295	100.0	.372	100.0		
1950	.261	88.5	.331	89.0		
1951	.249	84.4	.314	84.4		
1952	.303	102.7	.386	103.8		
1953	.310	105.1	.393	105.6		
1954	.311	105.4	.394	105.9		
1955	.303	102.7	.385	103.5		
1956	.317	107.5	.404	108.6		
1957	.342	115.9	.444	119.4		
1958	.332	112.5	.437	117.5		
1959	.322	109.2	.424	114.0		
1960	.320	108.5	.426	114.5		
1961	.323	109.5	.400	107.5	.396	100.0
1962	.320	108.5	.399	107.3	.396	100.0
1963	.317	107.5	.396	106.5	.392	99.0
1964	.315	106.8	.390	104.8	.386	97.5
1965	.328	111.2	.407	109.4	.403	101.8
1966	.355	120.3	.439	118.0	.435	109.8
1967	.393	133.2	.488	131.2	.483	122.0
1968	.404	136.9	.507	136.3	.502	126.8

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Printing, publishing and allied industries					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.300	100.0	.535	100.0		
1950	.300	100.0	.534	99.8		
1951	.309	103.0	.553	103.4		
1952	.305	101.7	.549	102.6		
1953	.300	100.0	.536	100.2		
1954	.301	100.3	.549	102.6		
1955	.300	100.0	.545	101.9		
1956	.282	94.0	.530	99.1		
1957	.291	97.0	.548	102.4		
1958	.290	96.7	.535	100.0		
1959	.284	94.7	.534	99.8		
1960	.283	94.3	.546	102.1		
1961	.275	91.7	.540	100.9	.535	100.0
1962	.274	91.3	.531	99.3	.527	98.5
1963	.273	91.0	.539	100.7	.534	99.8
1964	.263	87.7	.518	96.8	.512	95.7
1965	.257	85.7	.516	96.4	.510	95.3
1966	.253	84.3	.518	96.8	.514	96.1
1967	.256	85.3	.525	98.1	.519	97.0
1968	.258	86.0	.527	98.5	.522	97.6

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added activity

Table 34

	Iron and steel mills					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.525	100.0	.609	100.0		
1950	.469	89.3	.553	90.8		
1951	.438	83.4	.518	85.1		
1952	.451	85.9	.533	87.5		
1953	.505	96 2	.598	98.2		
1954	.402	76.6	.500	82.1		
1955	.390	74.3	.469	77.0		
1956	.386	73.5	.462	75.9		
1957	.405	77.1	.496	81.4		
1958	.378	72.0	.485	79.6		
1959	.374	71.2	.464	76.2		
1960	.409	77.9	.519	85.2		
1961	.374	71.2	.475	78.0	.472	100.0
1962	.362	69.0	.457	75.0	.457	96.8
1963	.352	67.0	.445	73.1	.445	94.3
1964	.349	66.5	.439	72.1	.439	93.0
1965	.334	63.6	.418	68.6	.418	88.6
1966	.356	67.8	.450	73.9	.452	95.8
1967	.374	71.2	.482	79.1	.484	102.5
1968	.357	68.0	.460	75.5	.461	97.7

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Agricultural implements					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.439	100.0	.558	100.0		
1950	.496	113.0	.633	113.4		
1951	.571	130.1	.718	128.7		
1952	.530	120.7	.666	119.4		
1953	.473	107.7	.636	114.0		
1954	.579	131.9	.817	146.4		
1955	.563	128.2	.770	138.0		
1956	.504	114.8	.713	127.8		
1957	.482	109.8	.675	121.0		
1958	.564	128.5	.782	140.1		
1959	.582	132.6	.791	141.8		
1960	.570	129.8	.856	153.4		
1961	.516	117.5	.826	148.0	.830	100.0
1962	.547	124.6	.825	147.8	.784	94.5
1963	.513	116.9	.730	130.8	.646	77.8
1964	.445	101.4	.655	117.4	.621	74.8
1965	.451	102.7	.651	116.7	.619	74.6
1966	.464	105.7	.662	118.6	.626	75.4
1967	.492	112.1	.709	127.1	.668	80.5
1968	.467	106.4	.715	128.1	.669	80.6

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing.
C — Based on total labour, value added total activity.

Table 34

	Motor vehicles					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.322	100.0	.421	100.0		
1950	.255	79.2	.332	78.9		
1951	.288	89.4	.374	88.8		
1952	.322	100.0	.425	101.0		
1953	.373	115.8	.480	114.0		
1954	.425	132.0	.601	142.8		
1955	.365	113.4	.499	118.5		
1956	.365	113.4	.503	119.5		
1957	.354	109.9	.508	120.7		
1958	.344	106.8	.511	121.4		
1959	.288	89.4	.415	98.6		
1960	.307	95.3	.445	105.7		
1961	.310	96 3	.443	105.2	.355	100.0
1962	.286	88.8	.384	91.2	.329	92.7
1963	.281	87.3	.368	87.4	.318	89.6
1964	.309	96.0	.406	96.4	.349	98.3
1965	.322	100.0	.406	96.4	.336	94.6
1966	.324	100.6	.423	100.5	.348	98.0
1967	.268	83 2	.349	82.9	.272	76.6
1968	.305	94.7	.306	94.1	.279	78.6

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Motor vehicle parts and accessories					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.451	100.0	.562	100.0		
1950	.448	99.3	.553	98.4		
1951	.448	99.3	.558	99.3		
1952	.455	100.9	.571	101.6		
1953	.454	100.7	.575	102.3		
1954	.437	96.9	.584	103.9		
1955	.428	94.9	.570	101.4		
1956	.402	89.1	.533	94.8		
1957	.418	92.7	.575	102.3		
1958	.413	91.6	.582	103.6		
1959	.409	90.7	.562	100.0		
1960	.407	90.2	.570	101.4		
1961	.455	100.9	.652	116.0	.731	100.0
1962	.433	96.0	.599	106.6	.671	91.8
1963	.414	91.8	.558	99.3	.630	86.2
1964	.452	100.3	.603	107.3	.684	93.6
1965	.456	101.1	.611	108.7	.689	94.3
1966	.412	91.4	.555	98.8	.627	85.8
1967	.401	88.9	.541	96.3	.610	83.4
1968	.414	91.8	.554	98.6	.626	85.6

A — Based on production labour, value added manufacturing

B — Based on total labour, value added manufacturing

C — Based on total labour, value added total activity

Table 34

	Smelting and refining					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.249	100.0	.303	100.0		
1950	.236	94.8	.290	95.7		
1951	.234	94.0	.287	94.7		
1952	.269	108.0	.330	108.9		
1953	.248	99.6	.305	100.7		
1954	.234	94.0	.291	96.0		
1955	.213	85.5	.266	87.8		
1956	.204	81.9	.255	84.2		
1957	.234	94.0	.299	98.7		
1958	.258	103.6	.346	114.2		
1959	.245	98.4	.319	105.3		
1960	.260	104.4	.336	110.9		
1961	.478	192.0	.631	208.3	.505	100.0
1962	.449	180.3	.599	197.7	.476	94.3
1963	.456	183.1	.634	209.2	.500	99.0
1964	.434	174.3	.588	194.1	.461	91.3
1965	.412	165.5	.559	184.5	.435	86.1
1966	.422	169.5	.595	196.4	.466	92.3
1967	.457	183 5	.623	205.6	.492	97.4
1968	.435	174 7	.621	205.0	.491	97.2

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Electrical products					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.363	100.0	.510	100.0		
1950	.349	96.1	.493	96.7		
1951	.378	104 1	.551	108.0		
1952	.368	101.4	.549	107.6		
1953	.359	98.9	.548	107.5		
1954	.344	94.8	.558	109.4		
1955	.346	95.3	.562	110.2		
1956	.335	92.3	.538	105.5		
1957	.334	92.0	.564	110.6		
1958	.342	94.2	.604	118.4		
1959	.324	89.3	.560	109.8		
1960	.319	87.9	.564	110.6		
1961	.312	86 0	.553	108.4	.498	100.0
1962	.302	83.2	.513	100.6	.460	92.4
1963	.308	84.8	.518	101.6	.467	93.8
1964	.302	83 2	.501	98.2	.452	90.8
1965	.309	85.1	.507	99.4	.453	91.0
1966	.314	86.5	.509	99.8	.453	91.0
1967	.325	89.5	.524	102.7	.468	94.0
1968	.326	89.8	.495	97.1	.442	88.8

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Cement manufacturers					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.209	100.0	.228	100.0		
1950	.210	100.5	.229	100.4		
1951	.217	103.8	.237	103.9		
1952	.221	105.7	.242	106.1		
1953	.203	97.1	.221	96.9		
1954	.219	104.8	.248	108.8		
1955	.219	104.8	.250	109.6		
1956	.222	106.2	.263	115.4		
1957	.213	101.9	.256	112.3		
1958	.197	94.3	.247	108.3		
1959	.197	94.3	.254	111.4		
1960	.192	91.9	.251	110.1		
1961	.169	80.9	.218	95.6	.217	100.0
1962	.164	78.5	.214	93.9	.213	98.2
1963	.154	73.7	.203	89.0	.203	93.5
1964	.146	69.9	.193	84.6	.194	89.4
1965	.155	74 2	.203	89.0	.204	94.0
1966	.162	77.5	.211	92.5	.211	97.2
1967	.174	83 3	.236	103.5	.237	109.2
1968	.165	78.9	.227	99.6	.228	105.1

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Petroleum and coal products					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.237	100.0	.338	100.0		
1950	.200	84 4	.307	90.8		
1951	.186	78.5	.289	85.5		
1952	.180	75.9	.282	83.4		
1953	.202	85.2	.315	93.2		
1954	.122	51.5	.194	57.4		
1955	.106	44.7	.174	51.5		
1956	.099	41.8	.167	49.4		
1957	.098	41.4	.166	49.1		
1958	.098	41.4	.174	51.5		
1959	.094	39.7	.172	50.9		
1960	.079	33 3	.145	42.9		
1961	.078	32.9	.142	42.0	.337	100.0
1962	.080	33.8	.146	43.2	.344	102.1
1963	.079	33.3	.143	42.3	.336	99.7
1964	.081	34.2	.148	43.8	.347	103.0
1965	.085	35.9	.158	46.7	.368	109.2
1966	.092	38.8	.166	49.1	.382	113.4
1967	.093	39.2	.168	49.7	.392	116.3
1968	.090	38.0	.159	47.0	.350	103.9

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	Chemicals					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.204	100.0	.349	100.0		
1950	.197	96.6	.337	96.6		
1951	.204	100.0	.342	98.0		
1952	.213	104.4	.358	102.6		
1953	.219	107.4	.367	105.2		
1954	.218	106.9	.372	106.6		
1955	.202	98.9	.350	100.3		
1956	.202	99.0	.361	103.4		
1957	.203	99.5	.367	105.2		
1958	.189	92.6	.352	100.9		
1959	.190	93.1	.347	99.4		
1960	.185	90.7	.339	97.1		
1961	.177	86.8	.327	93.7	.320	100.0
1962	.170	83 3	.317	90.8	.309	96.6
1963	.171	83.8	.318	91.1	.308	96.3
1964	.167	81.9	.310	88.8	.299	93.4
1965	.165	80.9	.309	88.5	.299	93.4
1966	.170	83.3	.310	88.8	.299	93.4
1967	.175	85.8	.298	85.4	.290	90.6
1968	.178	87.3	.285	81.7	.278	86.9

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

Table 34

	All manufacturing					
	A		B		C	
	Proportion	Index	Proportion	Index	Proportion	Index
1949	.368	100.0	.486	100.0		
1950	.350	95.1	.466	95.9		
1951	.354	96.2	.472	97.1		
1952	.365	99.2	.489	100.6		
1953	.368	100.0	.495	101.9		
1954	.357	97.0	.493	101.4		
1955	.342	92.9	.473	97.3		
1956	.343	93.2	.476	97.9		
1957	.348	94.6	.491	101.0		
1958	.340	92.4	.490	100.8		
1959	.343	93.2	.491	101.0		
1960	.338	91.8	.488	100.4		
1961	.338	91.8	.432	88.9	.443	100.0
1962	.317	86.1	.448	92.2	.471	106.3
1963	.330	89.7	.466	95.9	.467	105.4
1964	.330	89.7	.461	94.9	.460	103.8
1965	.332	90.2	.462	95.1	.459	103.6
1966	.338	91.8	.469	96.5	.466	105.2
1967	.342	92.9	.479	98.6	.475	107.2
1968	.340	92.4	.478	98.4	.471	106.3

A — Based on production labour, value added manufacturing
B — Based on total labour, value added manufacturing
C — Based on total labour, value added total activity

The fact is that the shares of income from value added paid to the labour and residual factors have, on the average, changed very little for the industries and time period studied. This is indeed in accord with what economists have been learning about the United States and Canadian economies ever since formulation of the well-known (to economists) Cobb-Douglas function.[14] It has been confirmed for the Canadian economy in a recent study:

"The labour share of corporate domestic income (domestic income minus entrepreneurial income) did not show any marked change from 1926-1930 to 1961-1965; the share increased by only 3 percent. When the government sector is excluded from the analysis, the labour share of corporate income does not show any change at all."[15]

The study also finds that for the economy as a whole, what changes have taken place are largely a result of sectoral shifts in the economy; for example, the great decline in the relative importance of agriculture and the shift of labour out of agriculture, and the increased importance of the government sector.

This does not mean that there have been no significant shifts in any industries. A glance at Table 36 (trend rate of change in labour share) shows that some have taken place; and Table 37, in depicting the rate of change in residual shares, shows the converse of the trends in labour's share, demonstrating the same fact.

For all manufacturing production labour's share of value added by manufacturing declined between 1949 and 1968 at an annual rate of -0.4 percent (which is statistically significant with an R of .703), but for total labour the share declined at a rate of only -0.2 percent per annum and is of dubious statistical significance (the R is only .335). For the more recent 1961-1968 period the labour share of value added by manufacturing increased at a rate of 1.1 percent per annum for production labour and 1.0 percent for total labour (R values being very high at .916 and .884), but the question is whether the increases are only a cyclical reversal from the decreases in the 1950's. There is really no significant 1961-1968 trend at all for the total labour share of value added by total activity, with a trend rate of 0.19 percent and a poor fit (R = .286), which can be understood from analysis of indexes of payroll as a percentage of value added in Table 34; the indexes for all manufacturing in column C move up from 1960 to 1961, down for the next three years, up for the next two, and down again for the last year.

While there are only three industries where the trend rate of change in production labour's share of value added, manufacturing, is not significant at the 95 percent level, and in 14 of them it is significant at the 99 percent level, it must be remembered that the actual change is, in most cases, quite small. For example, production labour's share in distilleries shows an annual rate of decline of -2.1 percent; with R at .822, it is significant at the 99 percent level and since R^2 is .676, it means that two-thirds of the shift in labour's share can be associated with the passage of time. But labour's share in 1949 was 14.1 percent and 2.1 percent of 14.1 percent is only .298 percent. Of course, as time passes, 2.1 percent of the diminishing labour share becomes even less. Thus, between 1967 and 1968 labour's share according to this trend would decline from 9.587 to 9.385 percent, a reduction of only .202 percentage points, compared with a reduction of .298 between 1949 and 1950. A -2.1 percent rate of decline means in this instance a reduction of 4.7 percentage points over 19 years, from 14.1 to 9.4. It might be noted, incidentally, that the actual proportion for 1968 was 9.3, almost identical with the calculated value of 9.4.

The industry chosen for the example has the second largest rate of change shown in the first column in Table 36. The industry with the smallest rate in that column is motor vehicle parts and accessories, with an annual rate of decline in labour's share of -0.3 percent and a 1949 labour share of 45.1 percent, as shown in Table 34. While this industry shows the smallest rate of change in labour share, proportion of value added (manufacturing) accounted for by payments to production labour was one of the highest in 1949, being exceeded by only four industries. That there is an inverse relation between the magnitude of the rate of change and the size of the labour share in 1949 is borne out by statistical analysis.[16]

The small amount of net change in the distribution of factor shares is shown by the figures for payroll as a proportion of value added for all manufacturing. With respect to production labour only, the 1968 proportion was 7.6 percent less than in 1949, 34.0 percent compared with 36.8 percent; and in 1962, the year of the greatest change from the base year, the proportion, at 31.7 percent, was 14.0 percent less than in 1949. Thus, the difference between the highest labour share, 36.8 percent, which happened to be in the base year, 1949, and the lowest, 31.7 percent in 1962, is 5.1 percentage points, or in relative terms, 14.0 percent.

While production labour's share for all manufacturing showed a slight rate of decline that is statistically significant, as pointed out above, there is little evidence of any trend between 1949 and 1968 for total labour. A rate of decline of -0.3 percent is shown in Table 36 but with R at .335, it is not even significant at the 95 percent level. The total labour share was 48.6 percent in 1949 and 47.8 percent in 1968, a difference of less than one percentage point; the greatest difference was between 1953 and 1961 when the labour shares were 49.6 and 43.2 percent, a difference of 6.3 percentage points. However, inspection of the data in Table 34 reveals no clear indication of an upward or downward trend.

To continue our analysis of all manufacturing, for the 1961-1968 period there is a stronger trend, at least with respect to value added by manufacturing, although it does not hold for value added by total activity. The production labour share shows a trend rate of increase of 1.1 percent per annum and the R value of .916 indicates a good fit to the trend line. The rate of increase of the total labour share, at .98 percent, is a little less, but still follows a strong trend, indicated by the R of .884.

Table 35

Index of change in Residual Share*

	Slaughtering meat processors			Bakery products			Distilleries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	97.6	95.4		100.7	101.8		101.7	103.0	
1951	96 5	93.6		103.3	106.0		101.1	102.6	
1952	102.3	106.4		103.4	106.5		99.9	101.4	
1953	98.8	98.6		101.3	103.5		99.5	101.3	
1954	98.9	96.8		97.3	97.5		99.5	101.7	
1955	101.8	103.4		95.9	96.5		98.5	100.8	
1956	94.1	91.2		93.2	92.9		98.1	100.6	
1957	95.5	92.8		94.7	94.1		99.0	101.1	
1958	94.9	92.1		94.3	93.6		99.9	101.9	
1959	94.2	92.6		93.6	92.8		100.8	102.8	
1960	92.0	87.5		93.1	90.9		102.3	103.9	
1961	89.3	82.1	100.0	96.6	97.4	100.0	102.8	103.0	100.0
1962	93.3	89.5	110.1	96.2	94.3	97.0	103.4	103.4	100.4
1963	93.0	90.1	110.8	95.1	93.3	96.3	104.8	105.4	102.4
1964	94.9	93.1	115.8	95.8	95.2	98.3	105.4	106.5	103.5
1965	94.9	91.3	114.3	96.2	94.5	98.0	104.8	105.4	102.4
1966	96.8	95.1	118.1	93.6	93.5	96.6	105.4	106.5	103.5
1967	97.0	99.2	123.6	91.8	92.3	95.0	105.2	106.1	103.0
1968	93.0	92.1	113.0	91.2	92.2	96.0	105.6	106.1	103.1

* The residual share is that portion of value added going, in the case of total labour, to the nonlabour factors and in the case of production labour, going to nonproduction labour as well as the nonproduction factors. The first two columns for each industry are related to value added by manufacturing and the third column, to value by total activity.

Source derived from data in source cited in Table 34.

Table 35

	Breweries			Tobacco			Rubber industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	101.1	100.3		103.5	104.3		106.5	113.1	
1951	99.7	98.2		96.4	93.6		107.6	114.1	
1952	99.4	98.9		102.3	102.4		108.1	113.4	
1953	101.3	101.8		102.1	102.8		106.8	111.9	
1954	100.9	100.5		102.3	103.7		103.1	104.0	
1955	102.1	101.6		104.2	106.7		108.6	115.0	
1956	101.5	100.2		103.2	104.9		106.5	111.4	
1957	102.0	101.6		99.5	99.5		101.5	100.4	
1958	102.1	101.4		100.1	99.8		106.2	106.9	
1959	102.1	101.3		104.4	105.3		102.8	102.3	
1960	102.4	101.1		106.8	107.9		99.6	95.0	
1961	103.7	103.1	100.0	109.6	112.0	100.0	99.0	96.6	100.0
1962	104.5	103.6	100.9	107.2	107.5	95.6	94.5	104.0	108.2
1963	105.2	104.0	101.3	107.3	110.1	98.4	94.2	94.1	100.0
1964	105.7	104.3	101.5	107.4	109.2	98.1	95.2	94.5	99.1
1965	104.8	102.4	99.7	111.5	115.4	103.1	97.6	98.0	102.5
1966	105.0	102.6	99.7	112.2	116.2	103.7	99.3	102.6	107.3
1967	105.2	102.7	100.1	112.0	114.4	102.1	102.1	105.0	109.1
1968	104.7	102.3	99.5	107.9	107.7	95.8	103.9	105.3	109.6

Table 35

	Cotton yarn and cloth mills			Synthetic textile mills			Clothing industries		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	103.5	103.7		105.1	104.0		99.0	96.5	
1951	100.1	97.5		104.1	102.8		98.4	96.4	
1952	90.3	78.8		105.8	100.7		98.6	99.6	
1953	78.1	61.5		95.6	84.4		95.9	95.8	
1954	89.1	74.2		97.7	80.4		94.5	91.9	
1955	88.3	66.6		101.2	87.1		96.2	95.6	
1956	98.0	78.7		94.6	73.4		94.4	93.1	
1957	102.8	84.0		96.5	76.9		95.2	92.2	
1958	105.3	80.7		101.5	82.9		95.9	93.9	
1959	109.4	89.7		108.4	95.9		95.8	94.5	
1960	111.2	95.0		108.6	98.5		96.4	93.3	
1961	114.7	102.8	100.0	111.7	99.5	100.0	94.1	92.9	100.0
1962	115.1	104.1	100.9	113.8	105.0	105.8	93.7	96.9	104.3
1963	120.2	111.7	107.9	115.2	109.9	110.6	94.2	99.5	107.5
1964	115.1	106.3	103.8	114.3	109.8	109.8	93.1	99.8	107.7
1965	113.8	104.5	102.5	107.1	95.5	95.2	92.7	99.1	106.9
1966	111.2	96.2	95.5	105.2	89.6	88.7	94.4	103.6	112.1
1967	105.9	86.7	85.1	104.6	90.2	90.7	92.8	97.6	110.3
1968	111.3	90.8	87.2	105.9	90.6	91.2	92.5	102.9	111.6

Table 35

	Furniture and fixtures			Saw and planing mills			Pulp and paper mills		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	100.6	99.3		107.8	110.9		104.8	106.6	
1951	102.8	101.0		104.9	107.1		106.6	109.3	
1952	104.2	102.3		101.4	100.5		98.8	97.9	
1953	98.1	92.7		100.6	98.4		97.9	96.7	
1954	101.6	98.3		100.7	98.5		97.8	96.6	
1955	101.8	98.2		103.3	101.6		98.8	98.1	
1956	102.3	99.7		99.5	95.0		96.9	95.0	
1957	102.2	97.4		92.8	84.4		78.9	104.8	
1958	105.4	101.6		95.1	87.8		94.8	89.7	
1959	104.1	98.6		97.4	90.7		96.2	91.9	
1960	103.8	97.1		92.2	83.0		96.5	91.5	
1961	107.6	104.8	100.0	92.3	83.9	100.0	96.1	95.6	100.0
1962	106.9	106.1	100.7	97.6	96.5	115.2	96.4	95.7	100.0
1963	107.2	101.3	96.9	100.2	99.3	118.0	96.8	96.3	100.8
1964	107.0	107.9	102.8	99.7	100.6	119.1	97.1	97.2	101.7
1965	107.7	110.2	104.8	95.9	96.4	113.5	95.3	94.5	98.9
1966	108.7	112.6	106.7	94.4	94.7	112.1	91.5	89.4	93.6
1967	109.8	113 1	107.1	94.0	94.0	111.5	86.1	81.7	85.6
1968	108.7	110.9	105.0	107.9	113.6	132.8	84.5	78.5	82.5

Table 35

	Printing, publishing and allied industries			Iron & steel mills			Agricultural implements		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	100.0	100.1		111.7	114.5		89.9	83.1	
1951	98.7	96.1		118.3	123.3		76.5	63.8	
1952	99.4	97.0		115.5	119.6		83.7	75.7	
1953	100.1	99.7		104.3	102.9		93.8	82.4	
1954	99.8	96.8		126.0	127.9		74.9	41.5	
1955	100.0	97.8		128.5	135.9		77.8	52.1	
1956	102.7	101.1		129.2	137.7		88.4	65.0	
1957	101.4	97.1		125.3	129.1		92.3	73.6	
1958	101.5	100.0		130.9	131.7		77.7	49.3	
1959	102.3	100.3		131.9	137.1		74.4	47.2	
1960	102.5	97.6		124.3	123.2		76.5	32.5	
1961	103 6	98.8	100.0	131.8	134.4	100.0	86.3	39.3	100.0
1962	103.8	100.7	99.8	134.3	138.9	102.8	80.6	39.7	127.4
1963	103.8	99.1	98.3	136.4	142.0	105.0	86.8	61.1	208.4
1964	105.3	103.6	102.8	137.1	143.5	106.2	98.8	78.1	223.6
1965	106 2	104.1	103.4	140.3	149.0	110.1	97.8	79.0	224.8
1966	106.7	103.6	102.5	135.7	140.7	103.8	95.5	76.6	220.5
1967	106.3	102.1	101.5	131.8	132.6	97.6	90.5	65.9	195.5
1968	106.0	101.6	100.7	135.4	138.1	102.1	95.0	64.4	194.8

Table 35

	Motor vehicles			Motor vehicle parts and accessories			Smelting and refining		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0				
1950	109.9	115.5		100.5	102.3				
1951	105.1	108.2		100.5	101.0				
1952	100.0	99.3		99.2	98.1				
1953	92.5	89.9		99.4	97.2				
1954	84.8	68.9		102.4	95.1				
1955	93.7	86.5		104.2	98.2				
1956	93.7	85.9		109.0	106.7				
1957	95.3	85.0		106.0	97.1				
1958	38.7	84.5		106.9	95.4				
1959	105.1	101.0		107.7	100.0				
1960	102.3	95.9		108.1	98.3				
1961	101.9	96.3	100.0	88.0	59.5	100.0	100.0	100.0	100.0
1962	105.4	106.4	104.0	103.2	91.6	122.4	105.6	108.5	105.9
1963	106.1	109.2	105.6	106.7	101.0	137.4	104.2	99.1	101.1
1964	102.0	102.7	100.9	99.7	90.6	117.4	108.5	111.5	108.9
1965	100.1	102.7	102.9	99.1	88.9	115.8	112.6	119.2	114.3
1966	99.7	99.6	101.0	107.1	101.7	138.9	110.8	109.6	108.0
1967	108.0	112.5	112.8	109.1	104.9	144.9	104.0	101.9	102.7
1968	102.6	104.4	111.8	106.7	102.0	139.1	108.2	102.6	102.9

Table 35

	Electrical products			Cement manufacturers			Petroleum and coal products		
	Production Labour	Total Labour		Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0		100.0	100.0	
1950	102.2	103.4		99.8	99.8		104.8	104.6	
1951	97.5	91.6		99.0	98.9		106.7	107.4	
1952	99.2	91.9		98.4	98.1		107.5	108.5	
1953	100.6	92.2		100.8	100.8		104.6	103.5	
1954	102.8	90.1		98.7	97.4		115.1	121.6	
1955	102.6	89.4		98.7	97.1		117.2	124.8	
1956	104.4	94.3		98.3	95.4		118.1	125.8	
1957	104.5	89.0		99.4	96.4		118.2	125.9	
1958	103.3	80.8		101.5	97.5		118.2	124.8	
1959	106.1	89.8		101.5	96.6		118.8	125.0	
1960	106.9	89.0		102.1	97.1		120.7	129.1	
1961	107.9	91.3	100.0	105.0	101.2	100.0	120.9	129.5	100.0
1962	109.5	99 2	107.6	105.6	101.8	100.6	120.5	129.0	99.0
1963	108.5	98.3	106.4	106.9	103.3	101.8	120.6	129.3	100.1
1964	109.5	101.7	109.4	107.9	104.5	102.9	120.4	128.6	98.6
1965	108.4	100.6	109.1	106.7	103.2	101.7	119.9	127.1	95.3
1966	107.6	100.2	109.0	105.9	102.2	100.8	119.0	125.9	93.2
1967	105.9	97.1	106.1	104.4	98.9	97.5	118.8	125.6	91.7
1968	105.7	103.1	111.2	105.5	100.2	98.6	119.3	128.2	98.1

Table 35

	Chemicals			All manufacturing		
	Production Labour	Total Labour		Production Labour	Total Labour	
1949	100.0	100.0		100.0	100.0	
1950	100.9	101.1		102.9	103.9	
1951	100.0	101.1		102.2	102.8	
1952	98.9	98.7		100.6	99.5	
1953	98.2	97.3		100.1	98.3	
1954	98.2	96.5		101.8	98.7	
1955	100.3	99.9		104.1	102.5	
1956	100.3	98.2		103.9	102.0	
1957	100.1	97.3		103.3	99.1	
1958	101.9	99.7		104.4	99.2	
1959	101.8	93.8		104.0	99.1	
1960	102.4	101.6		104.8	99.6	
1961	103,4	103.4	100.0	104.8	110.6	100.0
1962	104.3	105.1	101.6	108.2	107.4	95.0
1963	104.2	104.8	101.7	106.0	103.9	95.7
1964	104.7	106.0	103.1	106.0	104.9	96.9
1965	104.9	106.2	103.1	105.7	104.8	97.2
1966	104.3	106.1	103.1	104.9	103.4	95.8
1967	103.7	107.8	104.5	104.2	101.3	94.3
1968	103.2	109.8	106.2	104.4	101.6	95.0

Table 36

Annual Rate of Change* in Labour's Share of Value Added

	For 1949-1968 with respect to Production labour[x]			For 1949-1968 with respect to Total labour[x]			For 1961-1968 with respect to Production labour[x]			For 1961-1968 with respect to Total labour[x]			For 1961-1968 with respect to Total labour[x]		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	0.6	5.2	.520	0.4	5.6	.379	−0.5	2.6	.416	−1.0	2.6	.643	−1.0	2.7	.605
Bakery products	0.6	3.0	.757	0.5	2.7	.740	1.0	1.4	.868	0.3	0.7	.699	0.2	0.8	.511
Distilleries	−2.1	9.4	.822	−1.1	4.5	.826	−2.1	3.8	.760	−1.6	3.8	.666	−1.6	3.7	.681
Breweries	−1.6	3.7	.928	−0.7	3.6	.768	0.0	2.6	.022	1.1	2.1	.779	1.2	2.1	.783
Tobacco products	−1.5	6.1	.823	−1.3	6.3	.772	−1.7	6.8	.524	−1.2	8.1	.337	−1.1	8.1	.308
Rubber industries	1.3	6.9	.687	1.0	6.0	.664	−2.9	2.0	.968	−1.3	4.8	.539	−1.2	4.7	.532
Cotton yarn and cloth mills	−1.2	7.5	.713	−0.7	8.9	.450	1.7	3.3	.763	2.6	3.6	.854	2.6	3.6	.849
Synthetic textile mills	−0.9	9.6	.492	−0.2	11.4	.136	4.5	5.3	.878	4.5	5.8	.852	4.2	5.7	.846
Clothing industry	0.4	1.3	.854	−0.2	2.2	.519	−0.2	0.7	.580	−0.5	1.5	.570	−0.7	0.9	.871
Furniture and fixtures	−0.5	1.6	.882	−0.5	2.2	.787	−0.5	0.7	.863	−0.9	1.7	.798	−0.9	1.7	.786
Saw and planing mills	0.4	5.6	.384	0.2	7.3	.153	−0.6	5.7	.211	−1.0	5.0	.399	−0.8	4.4	.341
Pulp and paper mills	1.7	12.7	.596	1.8	8.5	.750	5.3	5.1	.914	5.3	5.6	.902	5.4	5.6	.901
Printing, publishing & allied industries	−1.0	1.7	.964	−0.3	1.6	.703	−1.1	1.7	.838	−0.3	1.6	.371	−0.3	1.7	.371
Iron and steel mills	−1.5	5.0	.822	−1.0	5.1	.724	0.4	3.5	.221	0.8	4.3	.361	0.9	4.4	.386
Agricultural implements	−0.7	9.6	.459	0.1	13.2	.064	−1.9	6.5	.553	−1.7	7.2	.458	−1.6	7.0	.390
Motor vehicles	−0.8	33.0	.158	−0.8	15.7	.310	0.6	7.5	.176	0.1	6.2	.046	−2.6	7.8	.596
Motor vehicle parts and accessories	−0.3	6.3	.233	0.2	8.0	.122	−1.0	4.1	.447	−1.3	3.5	.586	−1.2	4.0	.556
Smelting and refining	—	—	—	—	—	—	−0.4	3.8	.234	0.3	4.4	.152	0.2	4.9	.113
Electrical products	−0.9	3.6	.819	−0.5	5.4	.440	1.4	1.4	.914	−0.3	1.9	.291	−0.4	1.8	.438
Cement manufacturers	−1.8	6.6	.866	−0.7	8.1	.501	1.4	5.1	.498	2.2	5.7	.641	2.4	5.6	.675
Petroleum and coal products	−3.7	11.7	.786	−3.1	11.6	.768	3.0	3.7	.890	2.0	5.8	.641	1.8	5.5	.604
Chemicals	−1.2	4.6	.859	−1.0	5.4	.766	0.8	2.1	.649	−1.5	1.6	.903	−1.4	1.4	.929
All manufacturing	−0.4	2.4	.703	−0.2	3.3	.335	1.1	1.1	.916	1.0	1.3	.884	0.2	1.4	.286

* percentage rate, computed by least squares of actual values S — standard estimate of error R — goodness of fit ratio

x — The measures thus marked have been computed in relation to value added by manufacturing activity.

y — The measures thus marked have been computed in relation to value added by total activity.

The measures covering 1949 to 1968 are based on 1949 weights (ratio of labour compensation, or payroll, to value added) and those covering 1961 to 1968 use 1961 weights.

Source derived from data source cited in Table 34

Table 37

Annual Rate of Change* in Residual Share of Value Added

	For 1949-1968 with respect to						For 1961-1968 with respect to								
	Production labour[x]			Total labour[x]			Production labour[x]			Total labour[x]			Total labour[y]		
	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R	Rate	S	R
Slaughtering and meat processors	−0.3	2.9	.524	−0.4	5.3	.377	0.3	1.4	.416	0.8	2.4	.640	1.2	4.1	.605
Bakery products	−0.5	2.4	.754	−0.6	3.3	.742	−0.8	1.1	.868	−0.4	0.9	.707	−0.3	1.1	.491
Distilleries	0.4	1.6	.820	0.3	1.2	.826	0.3	0.6	.764	0.4	1.0	.661	0.3	0.9	.666
Breweries	0.3	0.8	.929	0.2	1.1	.766	0.0	0.5	.047	−0.3	0.6	.774	−0.3	0.6	.778
Tobacco products	0.6	2.6	.823	0.8	3.8	.772	0.8	2.9	.527	0.8	4.8	.338	0.5	3.6	.308
Rubber industries	−0.6	3.5	.686	−0.7	5.4	.668	1.8	1.0	.970	1.2	4.3	.539	1.1	4.2	.529
Cotton yarn and cloth mills	1.5	8.1	.714	1.4	13.0	.450	−1.8	3.6	.765	−3.4	5.2	.855	−3.2	5.0	.847
Synthetic textile mills	0.5	5.6	.493	0.3	11.0	.147	−2.3	3.1	.877	−3.3	5.3	.852	−3.4	5.6	.845
Clothing industries	−0.3	1.0	.855	0.3	3.0	.520	0.6	8.8	.153	0.6	2.2	.564	1.0	1.5	.871
Furniture and fixtures	0.5	1.6	.885	0.8	3.7	.790	0.5	0.6	.871	1.6	2.9	.791	1.3	2.4	.790
Saw and planing mills	−0.3	4.6	.385	−0.2	8.6	.153	0.4	4.6	.211	1.0	6.0	.397	1.1	7.5	.344
Pulp and paper mills	−0.7	5.3	.595	−1.0	5.1	.749	−2.0	2.2	.912	−2.8	3.3	.902	−3.2	3.7	.900
Printing, publishing & allied industries	0.4	0.7	.962	0.3	1.8	.701	0.5	0.8	.823	0.3	1.9	.365	0.3	1.8	.374
Iron and steel mills	1.2	5.6	.820	1.2	7.9	.724	−0.4	3.9	.223	−1.0	6.6	.364	−0.7	3.9	.386
Agricultural implements	0.9	7.5	.458	−0.3	16.7	.065	1.4	5.1	.553	1.8	9.1	.461	3.4	34.4	.392
Motor vehicles	0.4	15.7	.158	0.7	11.4	.311	−0.3	3.6	.175	−0.1	4.5	.044	1.4	4.3	.598
Motor vehicle parts and accessories	0.2	5.2	.233	−0.2	10.3	.122	0.6	3.3	.451	1.1	4.4	.585	2.5	10.8	.560
Smelting and refining	—	—	—	—	—	—	0.1	1.3	.228	−0.1	1.9	.158	−0.2	5.0	.113
Electrical products	0.5	2.1	.817	0.6	5.6	.440	−0.8	0.8	.917	0.2	1.9	.286	0.3	1.8	.418
Cement manufacturers	0.5	1.7	.865	0.2	2.4	.500	−0.3	1.3	.484	−0.6	1.7	.639	−0.6	1.5	.679
Petroleum and coal products	0.7	3.6	.786	1.1	5.9	.768	−1.0	1.2	.893	−1.1	3.0	.641	−0.9	2.8	.599
Chemicals	0.3	1.2	.861	0.6	2.9	.767	−0.2	0.5	.655	0.8	0.9	.904	0.7	0.7	.933
All manufacturing	0.2	1.4	.703	0.2	3.2	.333	−0.6	0.6	.916	−1.0	1.2	.886	−0.1	1.1	.285

* percentage rate, computed by least squares of actual values S — standard estimate of error R — goodness of fit ratio

x — The measures thus marked have been computed in relation to value added by manufacturing activity.

y — The measures thus marked have been computed in relation to value added by total activity.

The measures covering 1949 to 1968 are based on 1949 weights (ratio of labour compensation, or payroll, to value added) and those covering 1961 to 1968 use 1961 weights.

Source derived from data source cited in Table 34.

Table 38A

Minimum and Maximum Labour Share (production Labour, 1949-1968, VA mfg.)

Industry	Minimum	Maximum	(Max./Min.) 100	Difference[x] in percentage points Max.—Min.	1968-1949
Slaughtering and meat processors	33.8(52)	42.2(61)	124.9	8.4	4.5
Bakery products	42.5(52)	49.3(68)	116.0	6.8	4.9
Distilleries	9.4(66)	15.7(56)	283.0	6.3	4.7
Breweries	12.2(64)	17.4(52)	142.6	5.2	4.0
Tobacco products	21.1(66)	32.2(51)	152.6	11.1	5.6
Rubber industries	28.3(55)	37.7(63)	133.2	9.4	2.5
Cotton yarn and cloth mills	42.3(63)	62.5(53)	147.8	20.2	5.4
Synthetic textile mills	27.2(63)	42.6(54)	156.6	15.4	3.7
Clothing industries	44.2(49)	48.4(68)	109.5	4.2	4.2
Furniture and fixtures	44.2(67)	50.1(53)	113.3	5.9	4.4
Saw and planing mills	40.8(68)	49.4(60)	121.1	8.6	4.3
Pulp and paper mills	24.9(51)	40.4(68)	162.2	15.5	10.9
Printing, publishing & allied industries	25.3(66)	30.9(51)	122.1	5.6	4.2
Iron and steel mills	33.4(65)	52.5(49)	157.2	19.1	16.8
Agricultural implements	43.9(49)	58.2(59)	132.6	14.3	2.8
Motor vehicles	25.5(50)	42.5(54)	166.7	17.0	17.0
Motor vehicle parts and accessories	40.1(67)	51.7(61)	128.9	11.6	3.7
Electrical products	30.2(62)	35.9(53)	118.9	5.7	3.7
Cement manufacturers	14.6(64)	22.2(56)	152.1	7.6	4.4
Petroleum and coal products	7.8(61)	23.7(49)	303.8	15.9	14.7
Chemicals	16.5(65)	21.9(53)	132.7	5.4	2.6
All Manufacturing	31.7(62)	36.8(49)	116.1	5.1	2.8
(Excluding all manufacturing) Av.			151.3	10.4	6.1
σ			96.0	5.1	4.5
V			63.5%	49.0%	73.8%

[x]plus or minus signs omitted

Table 38B

Minimum and Maximum Labour Share, (Total Labour, 1949-1968, VA mfg.)

Industry	Minimum	Maximum	(Max./Min.) 100	Difference[x] in percentage points Max.-Min.	1968-1949
Slaughtering and meat processors	45.0(52)	57.5(61)	127.8	12.5	4.2
Bakery products	51.6(52)	58.7(64)	113.8	7.1	3.6
Distilleries	16.3(68)	21.1(49)	129.4	4.8	4.8
Breweries	17.0(64)	24.4(51)	143.5	7.4	1.8
Tobacco products	27.3(66)	41.4(51)	151.6	14.1	4.8
Rubber industries	39.4(55)	50.4(63)	127.9	11.0	2.8
Cotton yarn and cloth mills	54.7(63)	75.1(53)	137.3	20.4	3.8
Synthetic textile mills	42.7(63)	61.7(56)	144.5	19.0	4.9
Clothing industries	57.4(66)	62.2(54)	108.4	4.8	1.2
Furniture and fixtures	57.7(67)	65.4(53)	113.3	7.7	4.0
Saw and planing mills	48.1(68)	62.1(60)	129.1	14.0	6.2
Pulp and paper mills	31.4(51)	50.7(68)	161.5	19.3	13.5
Printing, publishing & allied industries	51.6(65)	55.3(51)	107.2	3.7	8.0
Iron and steel mills	41.8(65)	60.9(49)	145.7	19.1	14.9
Agricultural implements	55.8(49)	85.6(60)	153.4	29.8	15.7
Motor vehicles	33.2(50)	60.1(54)	181.0	26.9	2.5
Motor vehicle parts and accessories	53.3(56)	74.0(61)	138.8	20.7	8.0
Electrical products	49.3(50)	60.4(58)	122.5	11.1	1.5
Cement manufacturers	19.3(64)	26.3(56)	136.3	7.0	1.0
Petroleum and coal products	14.2(61)	33.8(49)	238.0	19.6	18.7
Chemicals	28.6(68)	37.2(54)	130.1	8.6	6.3
All manufacturing	43.2(61)	49.5(53)	114.6	6.3	8.0
(Excluding all manufacturing) Av.			140.1	13.7	6.3
σ			28.7	7.5	5.1
V			20.5%	54.7%	81.0%

[x] plus or minus signs omitted

Notwithstanding these statistically significant trend rates, their significance in terms of what they are actually measuring is doubtful. The annual rate of change of 1.1 percent in the production labour share for all manufacturing does not mean as much as first appears when it is seen that the labour share in 1962 (column A, Table 34) was 31.8 percent,[17] which means that the change between 1962 and 1963 would be only .4 percentage points and the total change up to 1968 amounts to 2.2 percentage points. The questionable significance of such a small change in the labour share over the 1961-1968 period is emphasized by the fact that while the trend rate for 1961-1968 is an annual rate of increase of 1.1 percent, for the longer 1949-1968 period, it is an annual rate of decrease of -0.4 percent.

To sum up: at the all-manufacturing level changes of the magnitude just discussed do not indicate any fundamental shift of factor shares. Of course, in some industries the shifts are more substantial, which is discussed presently. But, as a final comment on the all-manufacturing data for production workers, it must be observed that shifts in the labour share, as small as they may be, certainly mean something in relation to the individual worker. In 1968 wages per production worker averaged $5,406.87 (on the basis of the data used for this study and adjusted in the manner described in Chapter Four) and production worker wages were 34.1 percent of value added by manufacturing. In 1962 the labour share was 31.7 percent; if the same share had been in effect in 1968, the average annual wages per production worker would have been $5,026.23,[18] which is $380.64 or 7.0 percent less. (Obviously, the difference will be greater or less depending on the year with which 1968 is compared.) Such a difference is of more than neglible importance to the worker but is not great enough to be of any significance to the economist. (At least, that is the view offered here but the reader is free to make his own construction of the data.)

There is one important similarity between Tables 36 and 37 that is to be expected. The R values are virtually the same in both. The rate of change in the residual share (Table 37) works out to be equal to the rate for the labour share (Table 36), adjusted for the relative difference between the labour and residual shares in the base year, recognizing that the signs for the rates of change must always be different, one positive, one negative.[19] The corollary of this is that both follow the same trend and have the same goodness of fit. Because of this basic similarity our analysis is confined principally to change in the labour share which implicitly covers change in the residual share.

The unweighted average of the trend rates for the industries covered, shown in Table 32, is a decline of 0.7 percent in production labour's share of value added by manufacturing between 1949 and 1968 and a decline of 0.1 percent for total labour for the same period. The very high coefficient of variation for the latter figure indicates that it is a poor average because it is not especially representative; however, the fact that the rate of decrease is so much less than that for production labour reveals a shift of part of the labour share from production to nonproduction labour. For the 1961-1968 period this shift is no longer evident because there is an average annual rate of increase in the labour share of 0.3 percent for both production and total labour, with respect to value added, manufacturing. It also indicates, as we have already observed from the data for all manufacturing, a shift from a decrease to an increase in the labour share although we must once again remember that most of the changes are small.

Notwithstanding these small changes on the average, there were changes of greater magnitude in some industries. Some of them suggest a basic shift in factor shares, while others fluctuate considerably with no easily discernible longrun pattern.

In a few industries there was a clear upward or downward trend, with the lowest (or highest) value being in or near the base year and the highest (or lowest) near the terminal year. The clothing industries are an example where the minimum production labour share of 44.2 percent, found in 1949, grew to a maximum of 48.4 percent in 1968; but the difference is still only 4.2 percentage points. The minimum and maximum values between 1949 and 1968 and the years to which they apply are set out in Table 38. A reverse situation is that in iron and steel mills where the maximum share for production labour, 52.5 percent, applied to 1949 and it steadily diminished to the minimum share, 33.4 percent, in 1965 although there was a slight upward trend after that; but in this case the difference is more substantial than in clothing, amounting to 19.1 percentage points. This is the second largest difference in percentage points pertaining to production labour. The greatest difference, 20.2 points, is in cotton yarn and cloth mills but the maximum point was in 1953 and the minimum in 1963; however, the value increased only slightly after that time.

The minimum-maximum differences in percentage points are greater with respect to total labour than production labour for 18 of the 21 industries.[20] As shown in Table 38, the 21-industry average constituted a shift of 10.4 percentage points with respect to production labour and 13.7 points for total labour. The relative difference is, on the other hand, greater, at 51.3 percent, for production labour than it is, at 40.1 percent, for total labour, but this seems less significant than shifts in percentage points when it is realized that, for example, a change in the labour share from 10 to 11 percent is an increase of only one percentage point but of 10 percent. However, except for iron and steel mills, the relatively large changes all occured well within the 19-year period; that is, either the minimum or maximum values or both occured in years well removed from the base and terminal years. This can be seen from the fact that in most cases there is little similarity between the minimum-maximum and the 1949-1968 percentages. If there were a steady trend throughout the period, these differences would be much closer. This does happen in the case of distilleries with respect to total labour, where the base and terminal years are also the maximum and minimum years respectively, and where the R value of .826, indicating a good fit of the actual

to the trend values, is the highest such value for that series in Table 36. In the case of the clothing industries, with respect to production labour, where the minimum and maximum values also fall in the base and terminal years, the R value is .854, also indicating a good fit.

Of course, it is possible to have a good fit to the trend line even when the minimum and maximum values are not coincident with those for the base and terminal years. And such coincidence of values might sometimes occur where there is a poor trend because of wide fluctuations of values between the base and terminal years. The most reliable indication of trend is found in the data in Tables 36 and 37. This analysis of index numbers based on Table 38 is to indicate that substantial short-term shifts in factor shares have not necessarily indicated long-term change and, in fact, usually have not.

Statistical techniques and adjustments affecting the measurement of unit residual cost and changes in factor shares

Because the relation of unit labour cost and unit residual cost is one of the principal concerns of this study, as are changes in shares of income from the production process going to labour and residual factors, it is important to estimate the extent to which statistical adjustments to the raw data and the choice of statistical measurements affect the computations. Changes that are essentially statistical must be distinguished from those reflecting actual changes in economic activity.

Two kinds of statistical adjustments can affect the data. The first are those general revisions - the change in the Standard Industrial Classification, a new definition of the establishment, and the introduction of the total activity concept - that affect all the basic data to some extent, from 1961 on.[21] The data for 1961-1968 have been adjusted, in the light of the statistical revisions, to make them as comparable as possible with those for 1949 to 1960.[22] The differences between our measures of unit residual cost and changes in factor shares based on our adjusted compared with the unadjusted data for 1961-1968 are examined presently.

The second kind of adjustments or revisions are those made from time to time by Statistics Canada in the data for individual industries, changes necessitated in each case by conditions peculiar to that industry.

The particular statistical measure requiring some attention is the choice of base rather than current weights in computing unit residual cost. The computation of the index is discussed at the beginning of this chapter and in Chapter Three and it will be recalled that use of the labour weight (the ratio of payroll to value added) and the residual weight is essential to the calculation. If current rather than base weights had been used, not only would the measure of unit residual cost be different but so would changes in factor shares. The extent of the difference is discussed in the conclusion of this chapter.

The effect revisions in classification and definition

Turning first to the adjustments made necessary for 1961 to 1968 because of the revised definitions and classifications introduced by Statistics Canada, we can say that some of the differences between values based on adjusted and unadjusted data are great enough to be of some significance. However, the adjustment factor applied to the data was the same for all the years, 1962 to 1968 inclusive, so that there should be essentially no difference between trend rates or index numbers for those years, whether based on adjusted or unadjusted series.

It will be recalled that the adjustments affect only data from the annual census of manufactures; data on real output, obtained from another source, have not been affected. The most important series to be adjusted are those pertaining to payroll (total wages or total wages and salaries) and value added (by manufacturing only since value added by total activity was introduced in 1961, hence needed no adjustment to establish continuity with earlier years). The best measure of the significance of these adjustments can be obtained from a comparison of wages as a proportion of value added based on adjusted and unadjusted data. This appears in Table 39 in which wages as a proportion of value added, based on adjusted data, are expressed as a percentage of the proportion based on unadjusted data. The comparisons are based on averages of the data for 1962 to 1968.

For the most part the adjustments are not large enough to have any special influence on the computations. Even where they do, it must be repeated that they do not appreciably influence the computation of trends through the 1961-1968 period because all the annual data for this period (except for 1962) have been adjusted by the same factor. Furthermore, without such adjustments, attempts to analyze developments through the entire 1949-1968 period would be frustrated by breaks in 1961 in the continuity of the data occasioned by the statistical revisions with which we are here concerned. Where the adjustments are comparatively small, a good measure of continuity might have been maintained without altering the raw data; but this would have made the study less accurate than it would otherwise be. Where the adjustments are of greater magnitude, it is believed that continuity between 1949-1960 and 1961-1968 has been largely maintained, but is also means that the measures shown here for the more recent period will be rather different from those found in other studies covering part or all of the period since 1961 where there has been no need to make the adjustments carried out here.

Table 39

A Comparison of Labour's Share*, Based on Adjusted and Unadjusted Data

Industry	A	B	B/A	C	D	D/C	E	F	F/E
Slaughtering and meat processors	41.5	38.7	93.3	59.5	51.9	87.2	57.0	54.2	95.1
Bakery products	30.1	47.6	158.1	57.2	57.7	100.9	55.4	58.2	105.1
Distilleries	10.0	9.8	98.0	19.0	16.6	87.4	19.0	17.0	89.5
Breweries	13.5	12.8	94.8	27.4	20.5	74.8	27.0	21.4	79.3
Tobacco products	23.8	23.1	97.1	34.9	30.2	86.5	34.5	30.8	89.2
Rubber industries	34.5	35.2	101.9	48.6	47.1	96.9	46.6	45.0	96.6
Cotton yarn and cloth mills	45.0	45.7	101.5	59.1	59.4	100.5	58.6	58.9	100.6
Synthetic textile mills	34.5	30.8	89.4	48.8	48.5	99.4	48.6	50.1	103.1
Clothing industries	48.2	48.0	99.5	64.2	58.9	91.8	63.7	59.7	93.7
Furniture and fixtures	44.9	45.1	100.4	61.9	59.4	96.0	60.7	57.5	94.7
Saw and planing mills	47.2	45.9	97.3	58.1	54.6	94.1	56.7	56.7	100.0
Pulp and paper mills	34.7	34.7	100.0	43.5	43.2	99.3	43.2	42.8	99.1
Printing, publishing & allied industries	25.9	26.2	101.2	54.4	52.5	96.5	54.4	51.9	95.5
Iron and steel mills	36.4	35.5	97.5	46.2	45.0	97.4	45.7	45.1	98.6
Agricultural implements	47.7	48.5	101.6	64.8	70.6	109.0	59.8	66.2	110.6
Motor vehicles	30.9	29.9	96.9	46.7	45.7	97.8	40.0	37.5	93.9
Motor vehicle parts and accessories	43.0	42.6	99.1	56.8	57.4	101.1	55.7	64.8	116.3
Smelting and refining	36.3	43.8	120.6	51.0	60.3	118.2	49.2	47.4	96.4
Electrical products	32.8	31.2	95.2	54.7	50.9	93.1	51.8	45.7	88.3
Cement manufacturers	16.0	16.0	100.0	24.5	21.2	86.5	24.5	21.3	86.7
Petroleum and coal products	16.5	8.6	52.0	25.5	15.5	60.9	24.9	36.3	145.6
Chemicals	17.3	17.1	98.6	38.0	32.0	84.2	31.0	31.0	100.0
All manufacturing	33.6	33.3	99.0	52.9	46.6	88.1	50.4	46.5	92.3

*Labour's share is the proportion of payroll to value added, the measures averaged for the years 1962 to 1968, inclusive. Columns A and B pertain to wages for production workers as a proportion of value added by manufacturing, C and D, to wages and salaries combined, in relation to value added by manufacturing activity, E and F, wages and salaries as a proportion of value added by total activity. The measures in Columns A, C and E are based on unadjusted data, those in Columns B, D and F, on adjusted data. The other columns express the measures based on adjusted data as a proportion of the measures based on unadjusted data.

The adjustments are smallest of all in the case of production labour wages as a proportion of value added by manufacturing. For all manufacturing the difference between the measures based on adjusted and unadjusted data is only one percent. The (unweighted) average difference for the 22 industries is 8.0 percent. For 16 of the industries the difference is less than five percent, including two where there is no difference, for two the difference is between five and ten percent, and the remaining four show a difference of more than ten percent.

In the case of total wages and salaries in relation to value added by manufacturing, the difference for all manufacturing is more significant, at 11.9 percent. The (unweighted) average difference for the 22 industries is somewhat greater at 9.1 percent. For only ten industries is the difference less than five percent, compared with 16 in the case of wages for production labour only, in the case of four industries the difference is between five and ten percent, leaving eight industries with larger differences, compared with only four in the case of production labour only. Obviously, greater revisions have been made to salaries data than those covering wages only, necessitating the application of larger adjustment factors. This is because of the introduction of the total activities concept which meant bringing in data pertaining to employees, mostly those on salary, whose work is primarily or exclusively concerned with the nonmanufacturing activities of the enterprise that, when added to the manufacturing activities, comprise total activity.

Finally, when total wages and salaries are measured as a proportion of value added by total activity, the difference between the adjusted and unadjusted measures, at 8.4 percent, is less than that pertaining to total wages and salaries relative to value added by manufacturing but greater than that pertaining to production labour only and value added manufacturing. The difference is less than five percent for ten industries, between five and ten percent for four industries and more than ten percent for eight industries. It can be seen that the differences between the adjusted and unadjusted measures are greater for this group than for either of the other groups.

The largest differences for one group are not necessarily the largest for the other two groups. Thus, for the first group, represented by columns A and B in Table 39, the greatest differences are for bakery products and petroleum and coal products, but in the second and third groups the differences for bakery products are small, but continue to be substantial for petroleum and coal products.

What significance do these adjustments have? The two successive adjustment factors set forth in Appendix A show that for all manufacturing value added by manufacturing was revised downward first, by 2.5 percent, then 2.3 percent, accumulating to almost five percent. Mostly, this was because some of what had been value added by manufacturing was taken out, to be included instead in value added by total activity; for much the same reason data on production wages were revised downward but somewhat less than the data on value added, manufacturing, with the result that production worker wages, as a proportion of value added, manufacturing, are somewhat larger based on the unadjusted than on the adjusted data.[23] Analysis of the adjustment factors reveals that total wages are less under the new concepts and classifications than they would be under the old in 11 of the 22 industries, are more in eight of them, and there is no difference in the other three. In the case of total wages and salaries, the revisions have had a downward effect in seven industries and an upward effect in the other 15. The revisions have been downward for value added by manufacturing in 15 industries and upward for the other seven. (Since value added by total activity is a new measure introduced in 1961, the need for adjustments did not arise.)

The net effect has been that payroll as a percentage of value added by manufacturing is higher, on the basis of the revised concepts and classifications, for 14 industries with respect to wages only and for 17 industries with respect to total wages and salaries, and higher in both cases for all manufacturing. Similarly, total wages and salaries appear as a higher percentage of value added by total activity on the basis of the new measures than on the old in the case of all manufacturing and 15 industries.[24]

An examination of the significance of the new measures introduced in 1961 is not possible; most of the differences between the old and new series are small enough to have little significance. However, a few general observations can be offered.

Because, the wage bill is less for most industries under the new system compared with the pre-1961 series, absolute measures of unit labour cost based on unadjusted data tend to be lower than they would be if based on the adjusted data used in this study since data on industrial output (the denominator in the unit labour cost index) have not been changed.[25] Conversely, data on total wages and salaries have been larger under the new series compared with what they would have been in the old series, in most industries. The effect would be to show higher unit labour costs in absolute terms than data in our study would produce.

In the case of production labour, wages as a proportion of value added, manufacturing, are higher under the new series in 13 industries; with respect to total wages and salaries as a proportion of value added, manufacturing, they are higher for 17 industries, and for 15 industries, when related to value added by total activity. Where the labour share is higher, it means that while unit labour cost is also higher, unit residual cost is less.

While the classification and definitional revisions affect absolute measures for a given year, such as the dollar wage cost per unit of output, they have only a negligible effect on indexes of change and trend rates within the 1961-1968 period, because

the same adjustment factor is applied to all the years. Of course, if the adjustments were not made, there would be a break in the series after 1960 that would affect computations for the entire period.[26] Finally, it should be pointed out that even in the case of absolute measures for a point in time, it does not necessarily follow that because the values based on the new statistical series are different from what they would be under the old series, it means that one value is right and the other one is wrong. If, for example, unit labour cost is higher under the new series than the old, it need not mean that the old series understated this factor; this is because the new figures, to some extent, cover activities not covered before. Anyone seriously concerned with this must examine the statistical revisions for the series in which he is interested. With a few exceptions, this study does not concern itself with them at such a detailed level.

The difference between base-weighted and current-weighted data

In a study of this nature initial choices must be made as to methodology, selection of raw data and the techniques to be applied to them. For the purpose of this project, alternative calculations of unit residual cost were derived, on the one hand, from base-weighted data and, on the other, from current-weighted data. The weights are, of course, payroll as a proportion of value added, the base weight being the value for 1949 or 1961, as the case may be, the current weight being a one-year lagged moving weight, that is, the weight for the year preceding that for which the index of unit residual cost is being computed.[27]

The emphasis up to now has been on computations using base-weights. This enables us to analyze changes in unit residual cost and in the shares of value added going to labour and the residual input with the original factor income shares held constant. (It will be recalled that computation of unit labour cost does not depend on the use of weights.) It would be inappropriate to enter into the debate over the advantages and otherwise of base weights (the Laspeyres formula) and current weights (Paasche's formula). For purposes of longrun analysis it seems better to hold the proportions constant; to use current rather than base weights amounts to adjusting longrun trend for short-term changes. Nevertheless, where unit labour and unit residual cost have been behaving quite differently in relation to implicit, value-added price, current-weighted computations of change in unit residual cost and residual share of value added have the advantage of more accurately reflecting conditions at the time; they have the disadvantage of understating long-term trends.

The difference between current-weighted and base-weighted computations depends on two factors, the rate of change of unit labour cost and the rate and direction of change of the labour share.[28] Most differences are too small to be significant but there are exceptions.[29]

Where the current-weighted computations are sufficiently different from the base-weighted ones to call for comment, the comments appear in the industry-by-industry analysis in the next chapter. Current-weighted computations of change in the labour and residual shares were also carried out but are not discussed in this study because, as with most computations of unit residual cost, the differences between the current-weighted and base-weighted computations are too small to warrant special attention.

Footnotes

[1]One recent Canadian study does attempt such measurements. See H.H. Postner: op. cit.

[2]It is pointed out in parts of this chapter that when production labour only is taken into account, the residue includes nonproduction labour as well as the other factors specified on page 9 of Chapter Three. It is important enough for the reader to keep this in mind that it also be mentioned at the start of this chapter.

[3] $R = \frac{(va - w)_1}{(va - w)_0}$ A more complex formula for R/Y is given in Chapter Three, which was used for reasons explained there.

[4]The proof is as follows: Total income to the factors is represented in a given year by value added for that year, so that the share going to labour is represented by w/va. The change in the labour share is represented as $\frac{(w/va)_1}{(w/va)_0}$

This is equal to the index of unit labour cost divided by the index of implicit (value-added) price. Thus

$$\frac{W}{Y}\left(\frac{VA}{Y}\right)^{-1} = \frac{W}{Y} \times \frac{Y}{VA} = \frac{w_1/w_0}{va_1/va_0} = \frac{w_1/va_0}{w_0/va_1}$$

which is the same as $\frac{(w/va)_1}{(w/va)_0}$

By its nature, since $w + r \equiv va$, that is to say, is an identity, whatever happens to the share going to labour, an offsetting shift in the opposite direction occurs in the share going to the residual factor(s).

[5]What payroll consists of, aside from straight wages and salaries, and the difference between the two measures of value added are described in Chapter Four.

[6]The basis of these criteria of statistical significance is discussed in Appendix C.

[7]Nonlinear trends may be apparent in some industries but whether some of the nonlinear functions that have been computed can really be called a trend is debatable. And, as explained above, where the R is at least .529 (statistically significant at the 99 percent level), a better fit cannot be expected from a nonlinear regression.

[8]For a full explanation see page 10, Chapter Three.

[9]For the years 1961 to 1968 inclusive, the proportions are based on adjusted values for payroll and value added by manufacturing in order to maintain as much consistency as possible with data for earlier years. This is discussed in Chapter Four and Appendix A. As explained in Chapter Four, data on value added by total activity have not been revised because the total activity concept was introduced in 1961.

[10]For 1968 the indexes of unit labour cost, unit residual cost and implicit price were 147.1, 121.3 and 130.4 respectively; when considered as percentage increases over 1949 and applying the suitable weights, it works out as follows:

$$(47.1 \times .353) + (21.3 \times .647) = 30.4$$
$$16.6 + 13.8 = 30.4$$

and 16.6 and 13.8 are 54.6 percent and 45.4 percent respectively of 30.4. For 1965, it is as follows:

$$(17.4 \times .353) + (1.9 \times .647) = 7.3$$
$$6.1 + 1.2 = 7.3$$

with the percentages being 83.6 and 16.4 respectively. Of course, such a computation is not possible if one unit cost index is rising (that is, exceeds 100) and the other is falling (meaning it is less than 100). However, other ways of analyzing the components of price change, under such circumstances, are offered in Chapter Ten.

[11]Of course, if one wants to look at the situation in a given year or succession of years, one must use the index numbers for those years.

[12]This is discussed further at the end of the section in Chapter Ten covering slaughtering and meat processors and in mathematical terms in Appendix B.

[13]For the mathematical proof, see footnote 4 in this chapter.

[14]The Cobb-Douglas function is a mathematical formulation of the functional relation obtaining between changes in production and distribution of relative shares to the factors of production. It explains the relative constancy found in the share of wages to national income in the United States since the early 1900's. See Paul H. Douglas: *The Theory of Wages*, 1934. See also Paul H. Douglas: "Comments on the Cobb-Douglas Production Function" in Murray Brown (ed.): *The Theory and Empirical Analysis of Production;* National Bureau of Economic Research Studies in Income and Wealth, Vol. 31, 1967.

[15]Pradeep Kumar: *Long-Run Changes in the Labour Share of National Income in Canada, 1926-1956*, page 7; Industrial Relations Centre, Queen's University, Kingston, Ontario, 1971 (Research Series, No. 16).

[16]A rank (Spearman's) correlation between the rates of change in column 1, Table 36, and the labour proportion of value added in 1949, shown in column A of Table 34 for each industry, with rates of change ranked for largest to smallest and the labour proportions ranked inversely, from smallest to largest, shows a correlation coefficient of .651 (standard error of .224). However, cotton yarn and cloth mills and iron and steel mills are exceptions to the general rule and if they are omitted, with the ranking adjusted, the correlation becomes .896 (standard error, .236). With respect to total labour, 1949-1968, the correlation is .591 and with the same two industries removed, it becomes .667. There is less correlation for 1961-1968 with respect to the total labour share of value added, total activity; the correlation is .372 and removing the same two industries raises it only to .426.

[17]Because 1961 is the base year, the first year which is counted in computing the least squares trend line is 1962 because that is the first year in which there is a change from the base year.

[18]Calculated as follows: $5,406.87 (31.7/34.1) = $5,026.23

[19]It can be formulated as follows: $\dot{L}_s \times (L_s/R_s)_0 = \dot{R}_s$

where $\dot{L}_s$ and $\dot{R}_s$ are the rates of change of the labour and residual shares respectively and $(L_s/R_s)_0$ is the base-year ratio between the two shares. To take production labour in slaughtering and meat processors (1949-1968) as an example, and using data from Tables 34 and 36,

$$.58 \times (.343/.647) = .32$$

Since .58 has a positive sign, the rate of increase in labour's share, .32 must have a negative sign because an increase in the one share means a decrease in the other. The trend rate for change in the residual share, when calculated this way, is not quite the same as that shown in Table 37. The rates shown in Table 37 were computed from the basic data on the residual share and not according to the formula given here, which is presented solely to illustrate the relation between the two series. In most cases the difference between the rates computed the two ways is not great and can be explained by the effects of smoothing and rounding.

[20]For reasons explained already, data on the smelting and refining industry are not included in this analysis or any other analysis covering the full 1949-1968 period; the industry can only be examined in terms of 1949 to 1960 and 1961 to 1968, both periods considered separately.

[21]These are described in Chapter Four and the adjustments made for each industry are set forth in Appendix A.

[22]The advisability of making such adjustments and the reasons for using the 1949-1968 time period rather than 1961-1968, for which adjustments would not have been necessary, have already been advanced in Chapters Four and Five and need no repetition here.

[23]Lest there be some semantic confusion at this point, the reader should bear in mind that the term, "adjusted" applies to the raw data for 1962 and since, meaning that we have adjusted the data to make them as similar as possible to data for years preceding 1962 that are used in this study. Of course, the unadjusted data are those that are based on the revised definitions and classifications.

[24]When data are larger on the basis of the new concepts and classifications than they would be on the old basis, it means that they must be reduced by the extent to which the new values exceed what the old values would be; this is fully explained in Appendix A. This is necessary if there is to be continuity between 1949-1960 and 1961-1968. Thus, in Table 39, when column B is shown as 99.0 percent of column A for all manufacturing, it means that the data have been so adjusted to make labour's share 99.0 percent of what it appears to be on the basis of the new statistical series introduced in 1961 which have tended, as pointed out in the text above, to enhance labour's share in most industries.

[25]Of course, industrial output data have been revised a number of times, as pointed out in Chapter Four, but it has not been necessary to adjust them for purposes of continuity, so, in the context of the present discussion, they can be taken as unchanged.

[26]It might be argued that while it is necessary to adjust the 1961-1968 data when they are included in analysis of the full 1949-1968 period, it is not necessary when the analysis is confined to 1961-1968, as it is in some cases. However, it is felt that the advantages of using the same basic data, including adjusted 1961-1968 data, for all the analysis, avoiding the use of two different series of data for the more recent years, outweigh what seem to be doubtful advantages of using unadjusted data for 1961-1968 analysis.

[27]It will probably occur to the reader that the simplest technique would have been to calculate r each year by subtracting w from va, indexing the values to produce R, which, divided by Y, yields a current-weighted index of unit residual cost. (See footnote 3, this chapter). However, exactly the same results are achieved by the use of current (that is one-year lagged, moving) weights, which makes the formula consistent with what must be used when base weights are employed.

[28]The mathematics of this are set out in Appendix D.

[29]The interested reader may obtain data based on these computations upon request to the Economics and Research Branch, Canada Department of Labour.

CHAPTER TEN

Analysis by Industry

All the concepts and measures used in this study have now been introduced and described and the data have been presented. The next step is to describe the situation in each industry, one at a time, on the basis of the data already set forth.

This chapter does not introduce any new information except for brief reference to nonlinear trends where they appear to have greater statistical significance than linear trends. Where noteworthy, changes in basic data caused by statistical revisions are pointed out, as well as differences between base-weighted and current-weighted computations of unit residual cost and of changes in the residual share.

The significance of the nonlinear trend values, where given, is analyzed very little, if at all. This is because the significance, if any, is not always clear without considerably more analysis than time would permit. However, the information is presented so that it might be used, if so desired, in further research by readers of this study.

For each industry a summary table of principal statistics is given. The tables follow the usual breakdowns, containing data separately with respect to production labour and total labour, for 1949-1968 and 1961-1968, and, where applicable, separate data related to value added by manufacturing and value added by total activity. Some of the data presented in tables in previous chapters are depicted in charts, namely, trends in output per worker, unit labour cost, and unit residual cost, covering 1949 to 1968, and separately for production labour and total labour. Where the trend is obviously nonlinear, it is depicted in the charts as such, and a linear trend - shown in most cases - is not indicated.

Most readers will likely have a special interest in certain industries, reading only those parts of this chapter pertaining to them. In any event, the reader is advised to read the section on slaughtering and meat processors, the first one to appear, because certain observations are made that apply to the analysis of all industries but are not repeated in the other industry sections.

The analyses to follow can only point to some of the salient features of each industry's performance. They are not intended as a substitute for study of the previous chapters and the mass of statistics presented in the tables.

Slaughtering and meat processors

This industry does not rank high in importance in Canada's external trade, at least not according to the information in Table 1 (page 25) based on the situation in 1965; 8.9 percent of that year's value of production in the industry was exported and imports accounted for 4.9 percent of the value of market sales of the product of that industry. However, its great importance in the domestic consumer market is shown by the fact that the products of the industry account for 5.8 percent of the consumer price index.

Slaughtering and meat processors (Standard Industrial Classification code 101) includes establishments primarily engaged in the slaughtering of animals or packing of all meat products except poultry, which comprise a separate group not covered in this study. There were no changes in the 1960 S.I.C. revisions in the kinds of operations covered in this industry category, while changes in the data caused by the revisions are allowed for by adjustment factors set forth and explained in Appendix A.

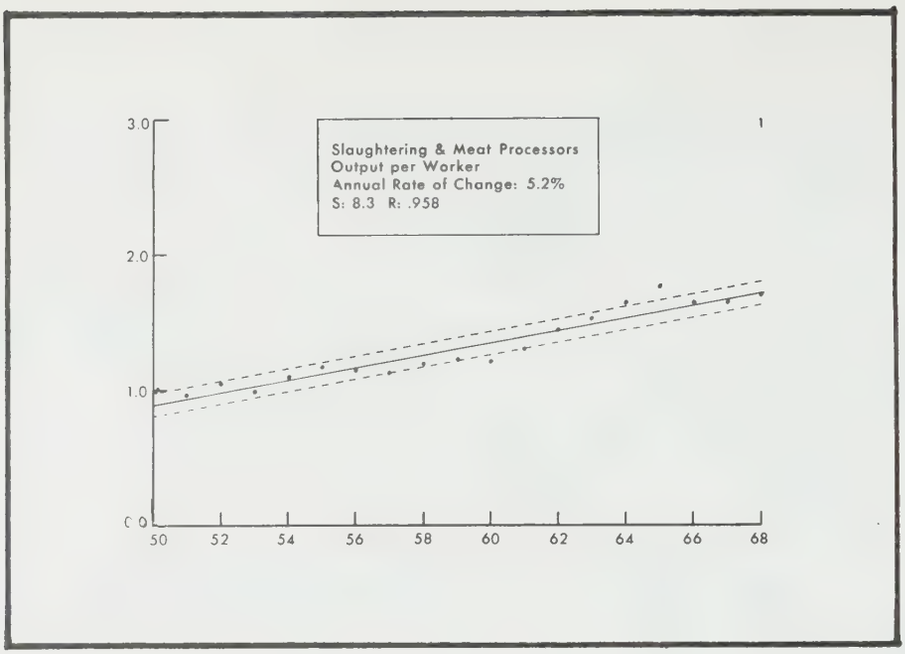
Neither output nor value added increased as much in this industry as in all manufacturing, an increase of 140.1 percent in production between 1949 and 1968, compared with 170.6 percent for all manufacturing, and of 48.2 percent between 1961 and 1968, compared with 61.1 percent (see Table 2). Between 1949 and 1968 value added increased 213.1 percent, compared with 259.9 percent for all manufacturing, and 67.6 percent for 1961-1968 compared with 71.0 percent. From 1961 to 1968 value added by total activity increased 66.8 percent compared with 78.1 percent for all manufacturing.

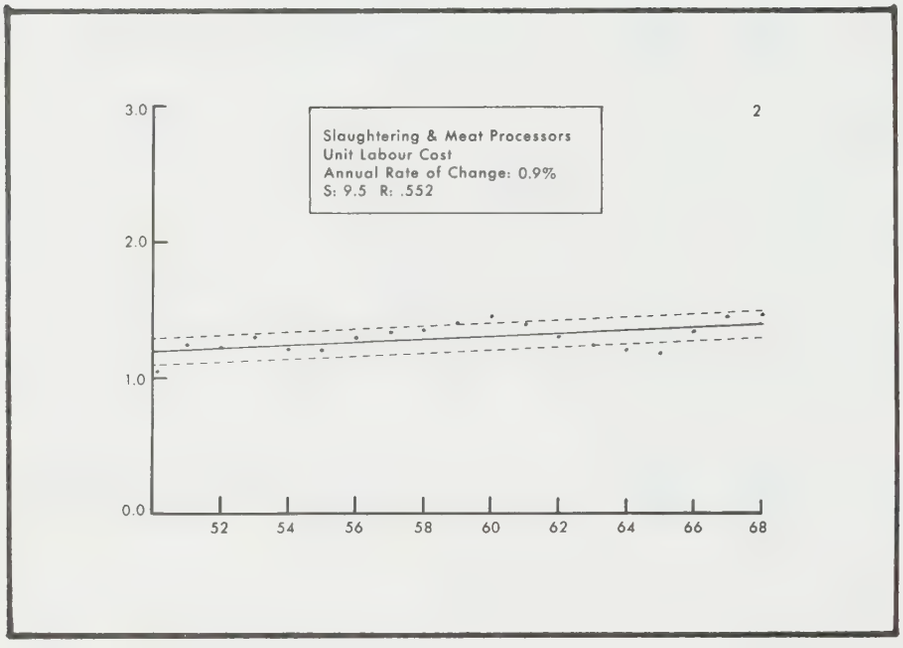
Over the full period[1] employment increased more than average,[2] 41.2 percent for production labour, compared with an average increase of 27.2 percent, and 37.4 percent for total labour compared with 32.8 percent (see Table 3). However, the

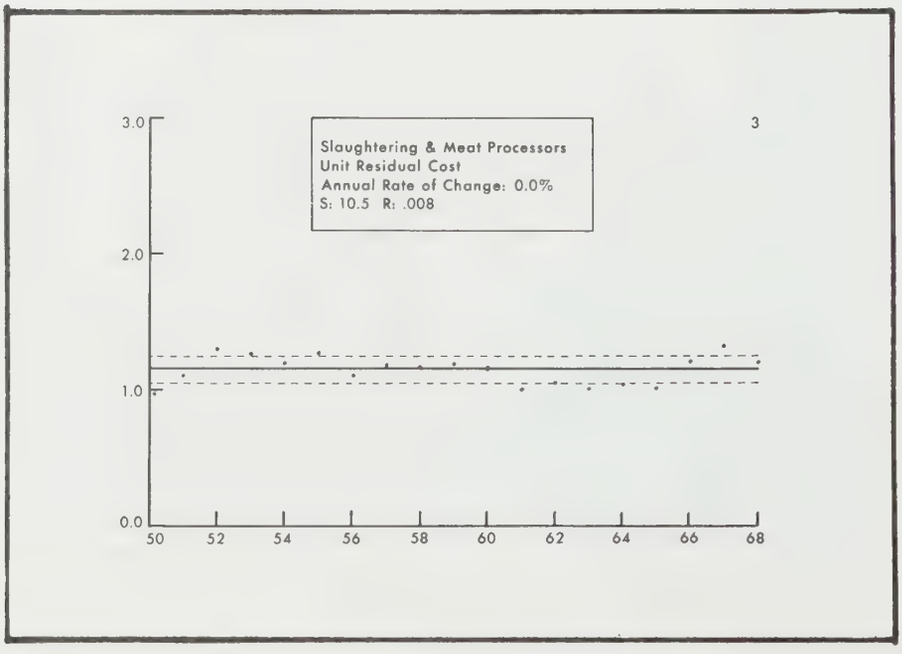
Summary Table — Principal Statistics

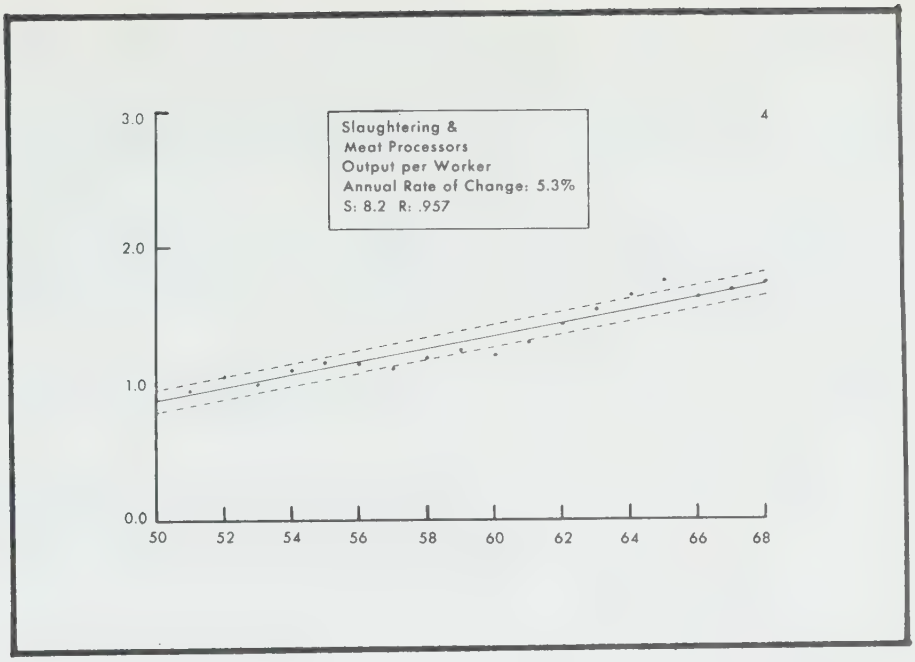
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			240.1			148.2			
Index of value added (1949 or 1961 = 100)			313.1			167.6		166.8	
Index of employment (1949 or 1961 = 100)	141.2	137.4		113.0	110.6				
Index of compensation per worker (1949 or 1961 = 100)	250.1	247.3		139.9	138.0				
Annual trend rate, compensation per worker	+6.9%	+6.8%		+6.0%	+5.9%				
Implicit, value-added price — index, 1949 or 1961 = 100)			130.4			113.1		112.5	
— Annual trend rate of change			+0.3%			+3.7%		+3.7%	
— R value			.242			.756		.767	
Output per worker — index, 1949 or 1961 = 100	170.0	174.7		131.2	134.0				
— Annual trend rate of change	+5.2%	+5.3%		+2.4%	+2.9%				
— R value	.953	.957		.727	.807				
Unit labour cost — index, 1949 or 1961 = 100	147.1	141.5		106.7	103.0				
— Annual trend rate of change	+0.9%	+0.8%		+3.0%	+2.5%				
— R value	.552	.496		.702	.680				
Unit residual cost — index, 1949 or 1961 = 100	121.3	120.1		117.8	126.7		127.2		
— Annual trend rate of change	0.0	−0.1%		+3.9%	+4.6%		+5.1%		
— R value	.008	.032		.753	.760		.763		
Payroll as a proportion of value added 1949	35.3%	48.2%							
1961				42.2%	57.5%		60.2%		
1968	39.8%	52.4%					55.1%		
Trend rate of change in labour share	+0.6%	+0.4%		−0.5%	−1.0%		−1.0%		
— R value	.520	.379		.416	.643		.605		
Trend rate of change in residual share	−0.3%	−0.4%		+0.3%	+0.8%		+1.2%		

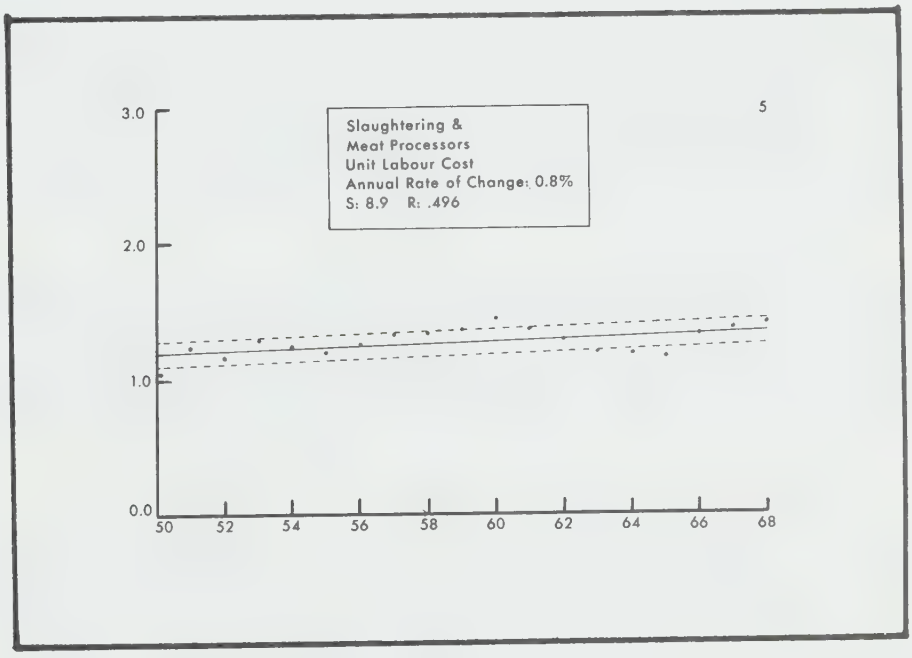
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

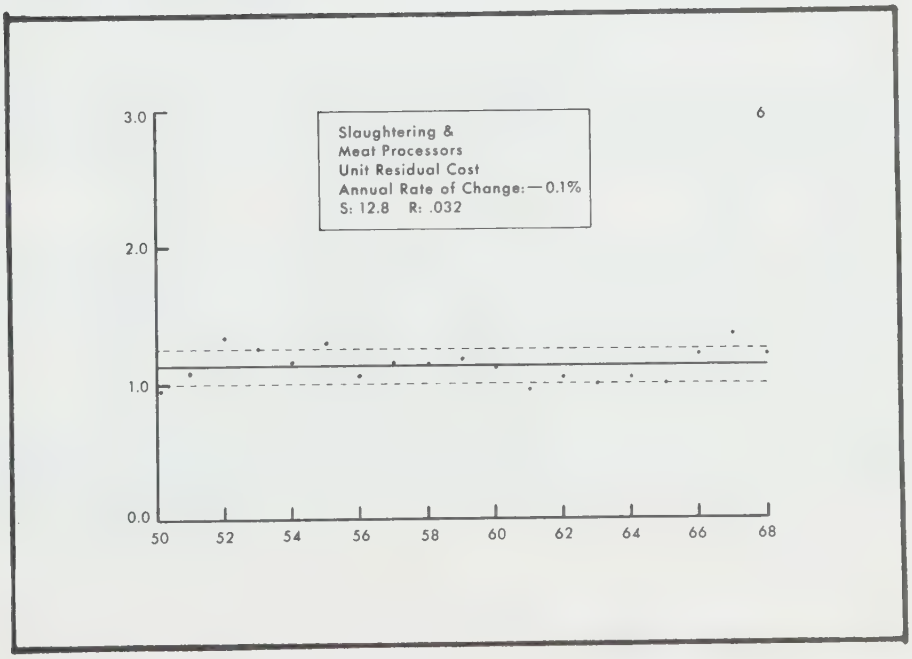

1
Slaughtering & Meat Processors
Output per Worker
Annual Rate of Change: 5.2%
S: 8.3 R: .958
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


2
Slaughtering & Meat Processors
Unit Labour Cost
Annual Rate of Change: 0.9%
S: 9.5 R: .552
3.0
2.0
1.0
0.0
52
54
56
58
60
62
64
66
68


3
Slaughtering & Meat Processors
Unit Residual Cost
Annual Rate of Change: 0.0%
S: 10.5 R: .008
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


4
Slaughtering &
Meat Processors
Output per Worker
Annual Rate of Change: 5.3%
S: 8.2 R: .957
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


5
Slaughtering &
Meat Processors
Unit Labour Cost
Annual Rate of Change: 0.8%
S: 8.9 R: .496
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


6
Slaughtering &
Meat Processors
Unit Residual Cost
Annual Rate of Change: —0.1%
S: 12.8 R: .032
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

reverse is true for the more recent shorter period, with production labour employment increasing 13.0 percent compared with an average of 19.7 percent and for total labour, 10.6 percent compared with 29.8 percent.

For both the short and full periods compensation (annual wages, annual wages and salaries) per worker increased less than average. For production workers the increase was 150.1 percent over the full period compared with an all manufacturing increase of 161.5 percent, and for total labour it was 147.3 percent compared with 166.5 percent; over the more recent period production worker compensation increased 39.9 percent compared with an average increase of 43.9 percent and for total labour it was 38.0 percent compared with 45.9 percent (see Tables 9A, 9B). The trend rates (Table 11) show a similar difference, with the industry rates being five to ten percent less than those for all manufacturing: for 1949-1968, 6.9 percent for production labour, compared with an average increase of 7.2 percent, and 6.8 percent for total labour compared with 7.5 percent; for 1961-1968, 6.0 percent for production labour compared with an average of 6.3 percent, and 5.9 percent for total labour compared with 6.3 percent. This difference is further borne out by the fact that the Canada Department of Labour wage rate index for 1968 for the industry is 137.9 (1961 = 100), compared with the slightly higher 140.6 for all manufacturing.[3]

This industry moved counter to the general trend in manufacturing in that there was a slight increase in the proportion of production workers to total employment, compared with a decline for most industries. It can be seen from Table 5 that the proportion of production workers was 2.8 percent greater in 1968 than in 1949 and the proportion of nonproduction workers 10.0 percent less, compared with a decline, for all manufacturing, of 4.2 percent in the production worker proportion and an 18.0 percent increase in the proportion of nonproduction workers. (The reader will recall from Chapter Four that head office employees have not been counted in this study.)

There are some sharp contrasts between the full-period and short-period behaviour of implicit (value-added) price, with a much higher rate of increase in the recent period, an annual trend rate of increase of 0.3 percent for 1949-1968 and of 3.7 percent for 1961-1968. For all manufacturing the trend was about the same for both periods, 1.0 percent for 1949-1968 and 0.9 percent for 1961-1968. However, the full period trend for slaughtering and meat processors has no statistical significance, with an R value of only .242, compared with .913 for all manufacturing. This can be easily understood from an examination of the implicit index for this industry in Table 12; while it was 130.4 in 1968, it was as high as 126.8 in 1953, only four years from the base year, and as low as 107.3 in 1965. In other words, there was no smooth upward trend as with all manufacturing. It should also be noted that the implicit price index based on value added by total activity is identical with that based on value added by manufacturing. (This covers only the short period.) However, in almost all the industries studied the trends are either identical or virtually identical for the two indexes.

A brief comparison of implicit, wholesale and retail prices that can be attributed to this industry is in order.[4] Between 1961 and 1968 the implicit price index rose 13.1 percent based on value added by manufacturing and 12.5 percent based on value added by total activity. Over the same period industry selling prices[5] for slaughtering and meat packing plants[6] rose 15.2 percent and the consumer (retail) price for beef rose 26.3 percent and 16.8 percent for pork. The slightly higher wholesale (industry selling) price increase, compared with implicit (value-added) price, must be attributed to rising costs of raw material and energy inputs to the industry, and the still greater retail price increases to higher costs or markups at the retail level.

Productivity of labour increased less in this industry than in all manufacturing, both over the full and short periods. Output per production worker was 70.0 percent greater in 1968 than in 1949, but the increase was 112.7 percent in all manufacturing; for total labour the increase was 74.7 percent compared with 103.7 percent in all manufacturing (see Table 17). The full-period annual trend rates of increase were 5.2 percent and 5.3 percent for production and total labour respectively, compared with 5.9 percent and 5.8 percent in all manufacturing. While the year-to-year changes in output per worker conformed well to the linear trend, as evidenced by the high R values, a cyclical pattern can be discerned from the charts. From 1955 to 1960 output per production worker held almost steady, showing an increase over the five years of only 4.8 percent; then, from 1960 to 1965 there was a steady rise amounting to 45.7 percent, and for the last three years it showed little change. The pattern is much the same when the industry's total labour force is taken into account.

That labour productivity increased at a slower rate in the 1960's than in the 1950's is consistent with the performance of most manufacturing industries. But the difference is somewhat more pronounced here. Output per production worker increased at an annual rate of 5.2 percent for the full period compared with 2.4 percent for the 1961-1968 period, a rate that is less than half of the full-period rate; for all manufacturing the comparable rates are 5.9 percent and 3.7 percent, the latter being about two-thirds of the former.

A similar comparison between this industry and all manufacturing is found for changes in the productivity of total labour. The short-period rate of 2.9 percent is only a little more than half the rate of 5.3 percent for 1949-1968, while for all manufacturing the rate of 3.9 percent for the more recent period is two-thirds of the 5.8 percent applicable to the full period. Labour productivity in slaughtering and meat processors deviated from that in all manufacturing more in 1961-1968 than in 1949-1968 and more for production labour than for total labour in both time periods.

While compensation per worker increased less than average over the full period, output per worker increased even more slowly (for example, production worker compensation followed a growth rate over the full period of about five percent less, while the rate for output per worker was 12 percent less); it must follow that unit labour cost would not only rise, but by more

than average. Since compensation per worker followed quite a smooth upward trend over the entire period, although at a somewhat reduced rate for 1961-1968, and since there was a decided drop in the rate of increase of labour productivity in the more recent period, it follows that unit labour cost increased more in the recent 1961-1968 period. This happens to be so for most manufacturing industries and the difference between the 1961-1968 and 1949-1968 rates for this industry is close to that for all manufacturing.

An examination of the charts on unit labour cost reveals an even more definite cycle than is evident for output per worker. With respect to production labour it increased 21.2 percent between 1955 and 1960, decreased 19.6 percent over the next five years up to 1965, and increased 25.4 percent over the three following years to 1968 (see Table 24). A similar pattern is also apparent for total labour.

Unit residual cost showed no net change at all over most of the full period. This is evident from the charts and from the fact that no trend rate of change is indicated with respect to production labour and, in effect, no change with respect to total labour either. It is only from 1965 to 1968 that there was a definite increase which is equally evident with respect to both production and total labour (see Table 28). A similar increase since 1965 is also apparent from the charts for unit labour cost; the difference is that unit labour cost declined at a steady rate from 1960 to 1965 while unit residual cost held virtually steady from 1961 to 1965 although it did drop between 1960 and 1961.[7]

For most industries unit residual cost followed a quite definite path, either up or down, but the upward movement in some industries was pretty well offset by downward movement in others so that the all-manufacturing trend was less positive than for most of the constituent industries. However, in slaughtering and meat processors, as pointed out above, there was not much of a trend except for the last few years leading up to 1968.

In 1949 the labour share,[8] at 35.3 percent for production labour and 48.2 percent for total labour, was quite close to that for all manufacturing, at 36.8 and 48.6 percent respectively. By 1961 the labour share had increased considerably, from 35.3 to 42.2 percent for production labour, and from 48.2 to 57.5 percent for total labour. This is in sharp contrast with all manufacturing where the production labour share declined from 36.8 to 33.8 percent and the total labour share from 48.6 to 43.2 percent. Between 1961 and 1968 the contrast continues because the production labour share reversed and declined from 42.2 to 39.8 percent, which was still higher than the 1949 share of 35.3 percent. Meanwhile the all-manufacturing production labour share rose slightly from 33.8 to 34.0 percent. For the industry the total labour share dropped from 57.5 percent in 1961 to 52.4 percent in 1968, in contrast with a rise in all manufacturing from 43.2 to 47.8 percent.

The annual trend rate of increase in the production labour share for the full period is 0.6 percent but it is not a strong trend since the R value is .520. A glance at column A to Table 34 for this industry shows why; there have been many fluctuations in the year-to-year movements and two years show lower values than for 1949, while two years show values higher than for 1968. The annual rate of increase in the total labour share over the full period is even weaker and for the same reason. As our analysis in the previous paragraph indicates, the labour share (both production and total labour) showed a moderate annual rate of decline between 1961 and 1968 although the trend was not a strong one, as indicated by the rather low R values.

There is nothing especially unusual about the behaviour of factor shares in this industry. It can be seen from Table 36 that the rate of change is indeed greater in most industries than this one. Over the full period there has been less indication of any longrun change in the shares, as evidenced by the fact that the R values are higher for most of the other industries. A reversal of trend in the 1960's from the 1950's happened in many industries. Of course, if the factor shares cannot be expected to change very much in the long run, as was suggested in the previous chapter, we must expect such fluctuations if the longrun share is to be more or less constant. The considerable fluctuations in unit labour and unit residual cost over 1949-1968 and the weak R values for this period led to nonlinear trends being computed which produced a better fit only for unit labour cost, total labour, 1949-1968 (see Appendix C).

To conclude the analysis of slaughtering and meat processors - and each industry analysis concludes this way - the equations showing the unit cost components of implicit (value-added) price change are presented here.

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.9	x	.353)	+	(0.1	x	.647)	=	0.3	0.3
Tot. lab., 1949-68[x]	(0.8	x	.482)	+	(-0.1	x	.518)	=	0.3	0.3
Prod. lab., 1961-68[x]	(3.0	x	.422)	+	(3.9	x	.578)	=	3.5	3.7
Tot. lab., 1961-68[x]	(2.5	x	.575)	+	(4.6	x	.425)	=	3.4	3.7
Tot. lab., 1961-68[y]	(2.5	x	.602)	+	(5.1	x	.398)	=	3.5	3.7

x - related to value added by manufacturing activity
y - related to value added by total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

The rates of change for implicit price in column A are what result from the equation presented above. The rates in column B are in effect least squares trend rates of implicit (value-added) price (that is, VA/Y) based on the computed values for each year. Where there is a difference, the column B values must be accepted as the more accurate, the column A values indicating the result obtained from the equation that is given. Differences result partly from rounding of data but there are more important reasons that are explained in technical terms in Appendix B. It comes down to the fact that we are trying to combine linear trend rates of change for unit labour and unit residual cost to produce a linear trend rate for implicit (value-added) price. This is a valid procedure when there is a strong linear trend (indicated by statistically significant R values) in every case. Where this is not so, it means trying to add what purport to be trend rates but may in fact represent very weak trends, or there may be a nonlinear trend of some sort for at least one of the measures, which means that it cannot be expressed accurately as an average annual value.

In this very industry, slaughtering and meat processors, the R for full-period implicit price change at .242, is below the 95 percent level of significance; this is because of the "no net change" trends in unit residual cost although unit labour cost followed a significant trend with R values of .552 and .496 with respect to production and total labour respectively.

It is impossible, within the confines of this study, to discuss the statistical significance of every equation for each industry. The reader must be cautioned to draw his own conclusions after examining the relevant R values in each case.

Over the full period unit labour cost increased while unit residual cost either remained constant (in the case of production labour) or declined (total labour). (The reader must once more be reminded that, with respect to production labour, unit residual cost includes salaries and other compensation to nonproduction labour; it is only with respect to total labour that unit residual cost contains no labour cost element.) However, between 1961 and 1968 both forms of unit cost were components of the implicit (value-added) price increase. There was also a reversal from the full-period situation in that unit residual cost increased more substantially than unit labour cost. This is especially notable in the last two equations pertaining to total labour where unit residual cost contains no labour component. In other words, nonlabour unit costs of production increased more during the recent short period than labour costs. Among these nonlabour costs is the profit earned by the industry, but this study does not attempt to isolate profit from the other nonlabour components of unit cost. This would be a research project in itself.

Bakery products

Exports and imports are of negligible importance to this industry, according to 1965 data in Table 1. Only 0.6 percent of the value of the industry's output was exported and only 0.9 percent of value of bakery products consumed domestically was imported. Some of the industry's main products, bread, cookies, sweet biscuits, soda crackers, cake and doughnuts, account for 2.6 percent of the consumer price index.

The bakery products industries, as they are designated in the Standard Industrial Classification manual (Catalogue No. 12-501)[9] consists of biscuit manufacturers (S.I.C. code 128), including the manufacture of biscuits, cookies, crackers, etc., and bakeries (S.I.C. code 129) including bread, cakes, pies, puddings, pastries, rolls, etc.

Production, value added and employment all increased much less than average (i.e. for all manufacturing), but compensation (annual wages, annual wages and salaries) per worker kept pace over the full period while falling behind in the shorter (1961-1968) period. Labour productivity increased considerably less than average over both time periods while both unit labour and unit residual cost increased much more than average. Understandably, therefore, we find that implicit (value-added) price increased more than average. There was some increase in both the production and total labour share over both the full and short periods.

Only three of the industries studied showed a smaller increase in production between 1949 and 1968 than the 74.3 percent recorded for this industry and which compares with 170.6 percent for all manufacturing (see Table 2). Over the short period there are also only three industries with smaller increases in output than the 19.2 percent for bakery products, which compares with 61.1 percent for all manufacturing. With respect to value added by manufacturing it is somewhat higher on the list with five industries out of 21 showing smaller increases for the full period and five industries out of 22 of the shorter period.[10] The increases for the full and short periods are 171.4 and 38.7 percent respectively, comparing with 259.9 and 71.0 percent for all manufacturing.

Production labour employment increased only about half as much as the average over the full period, by 14.5 percent compared with 27.2 percent for all manufacturing, and total employment only one-third as much, by 11.2 percent compared with 32.8 percent (see Table 3). Over the more recent 1961-1968 period employment hardly changed, with production labour increasing 2.3 percent and total labour, 1.0 percent.

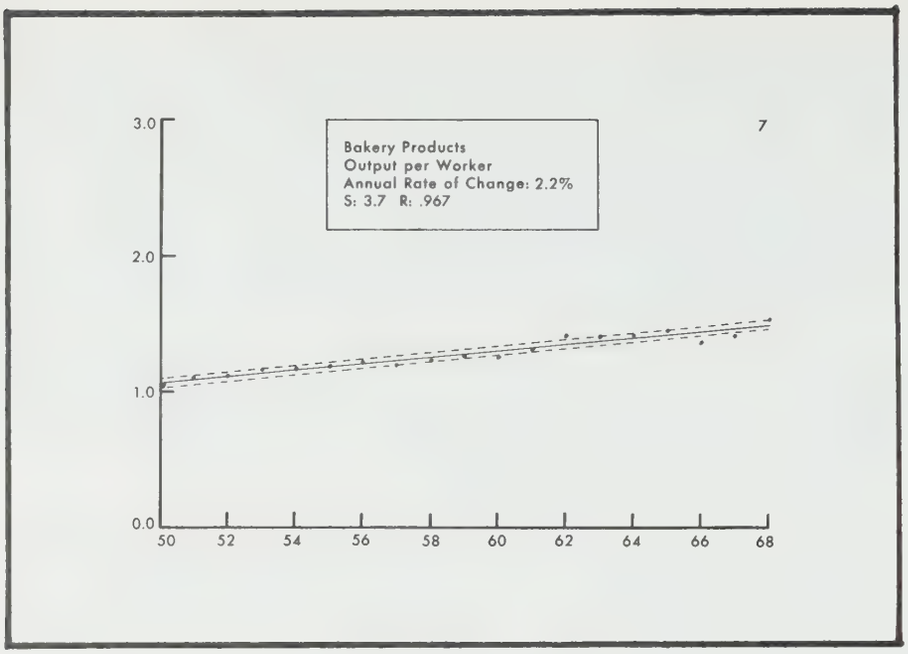
As can be seen from Table 5, bakery products is one of only four industries where the proportion of production workers to total employment increased between 1949 and 1968. However, not too much significance should be drawn from this because of a zero trend rate. In effect, it means that the proportions of production and nonproduction labour remained comparatively steady over the full period.

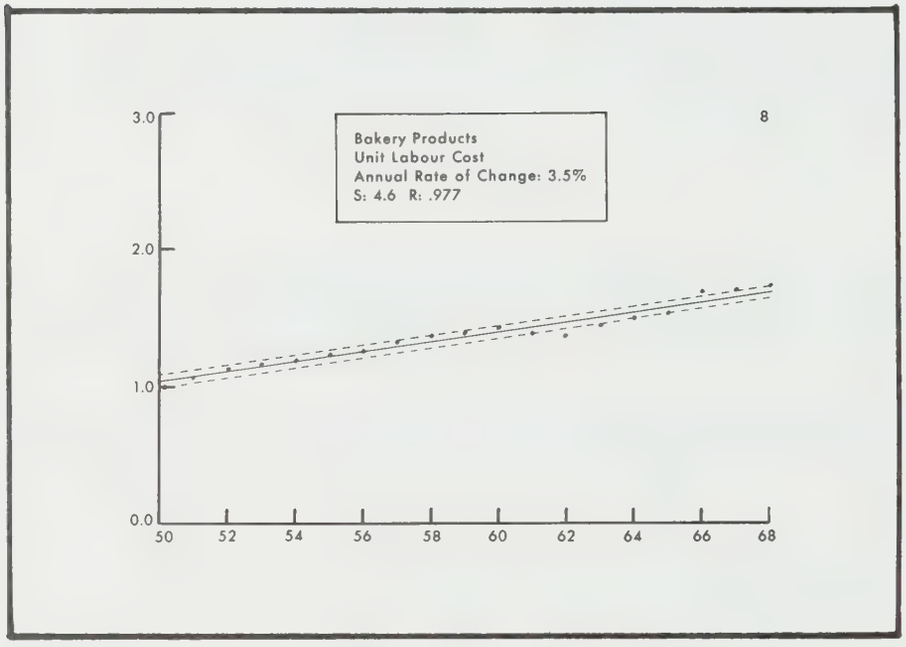
BAKERY PRODUCTS

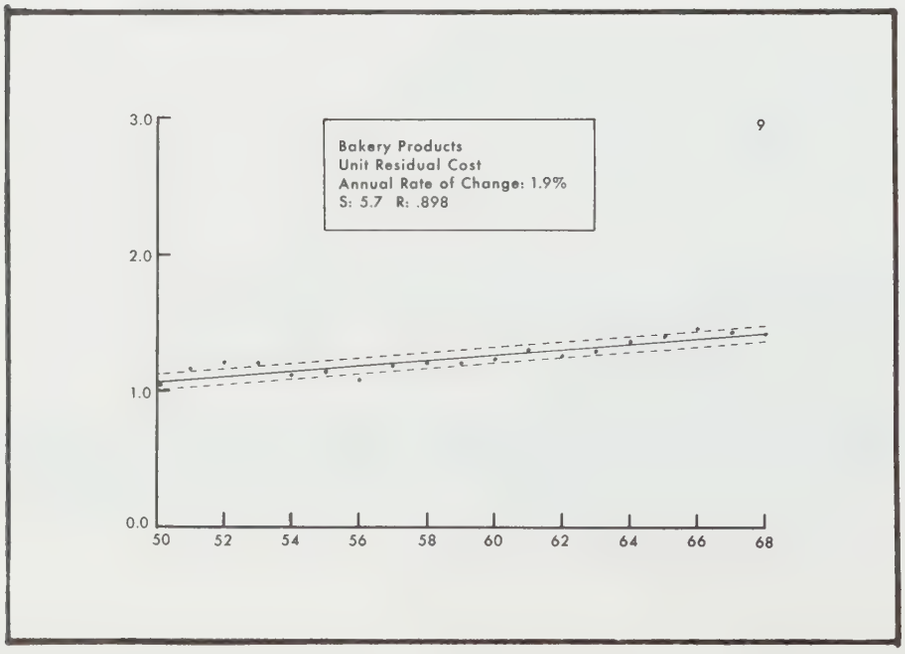
Summary Table — Principal Statistics

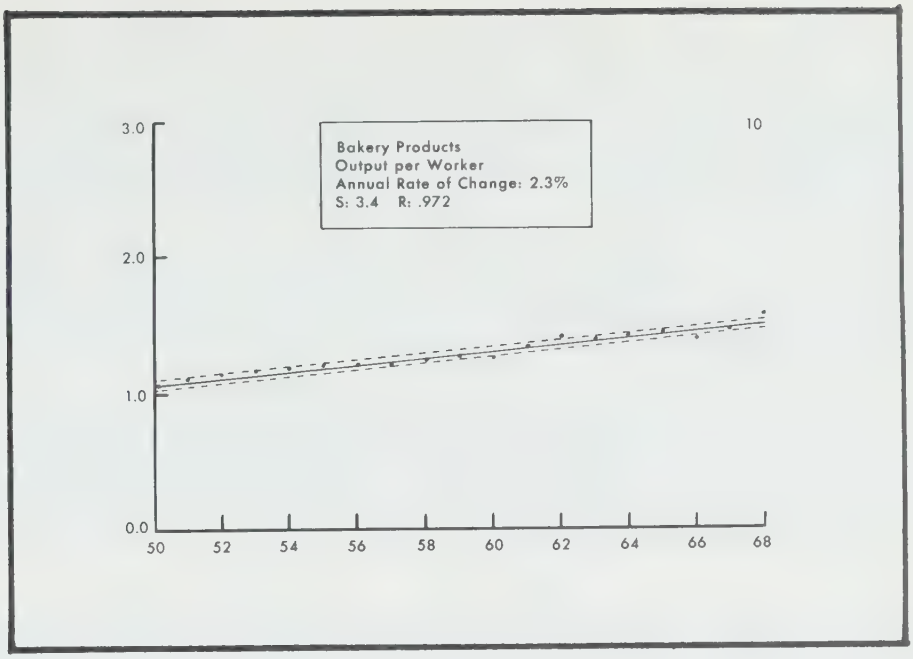
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			174.3			119.2			
Index of value added (1949 or 1961 = 100)			271.4			138.7		140.5	
Index of employment (1949 or 1961 = 100)	114.5	111.2		102.3	101.0				
Index of compensation per worker (1949 or 1961 = 100)	263.1	260.1		144.4	143.4				
Annual trend rate, compensation per worker	+7.4%	+7.3%		+5.7%	+5.6%				
Implicit, value-added price — index, 1949 or 1961 = 100)			155.7			116.5		117.8	
— Annual trend rate of change			+2.6%			+3.4%		+3.5%	
— R value			.967			.956		.963	
Output per worker — index, 1949 or 1961 = 100	152.2	156.8		116.5	118.0				
— Annual trend rate of change	+2.2%	+2.3%		+0.8%	+1.4%				
— R value	.967	.972		.467	.685				
Unit labour cost — index, 1949 or 1961 = 100	172.9	166.0		124.0	121.5				
— Annual trend rate of change	+3.5%	+3.4%		+4.6%	+3.8%				
— R value	.977	.984		.973	.969				
Unit residual cost — index, 1949 or 1961 = 100	142.1	143.5		109.9	110.1		113.1		
— Annual trend rate of change	+1.9%	+1.7%		+2.4%	+2.9%		+3.2%		
— R value	.898	.838		.887	.921		.933		
Payroll as a proportion of value added 1949	44.4%	54.5%							
1961				46.3%	55.8%		56.9%		
1968	49.3%	58.1%					58.6%		
Trend rate of change in labour share	+0.6%	+0.5%		+1.0%	+0.3%		+0.2%		
— R value	.757	.740		.868	.699		.511		
Trend rate of change in residual share	−0.5%	−0.6%		−0.8%	−0.4%		−0.3%		

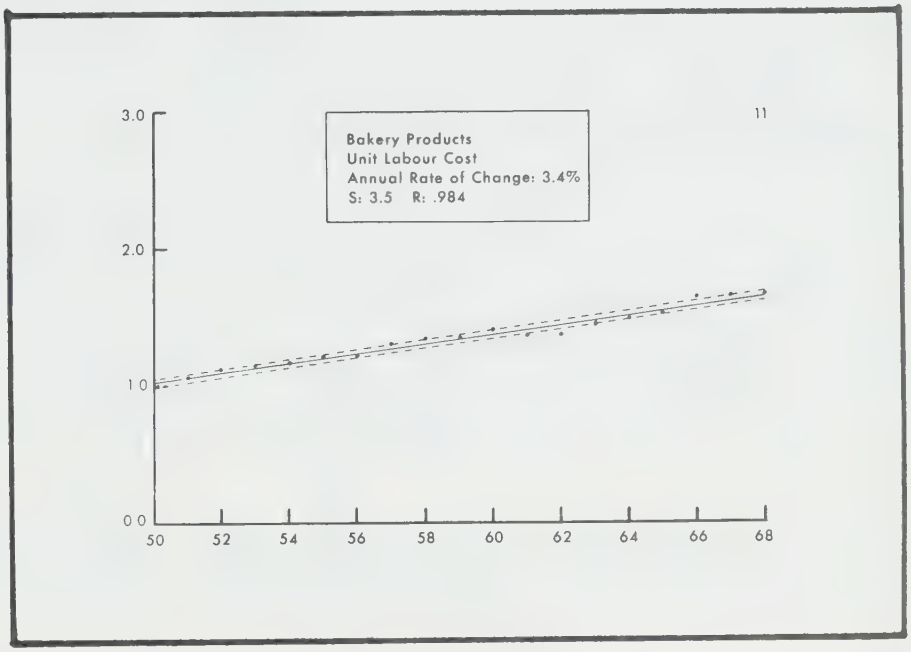
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

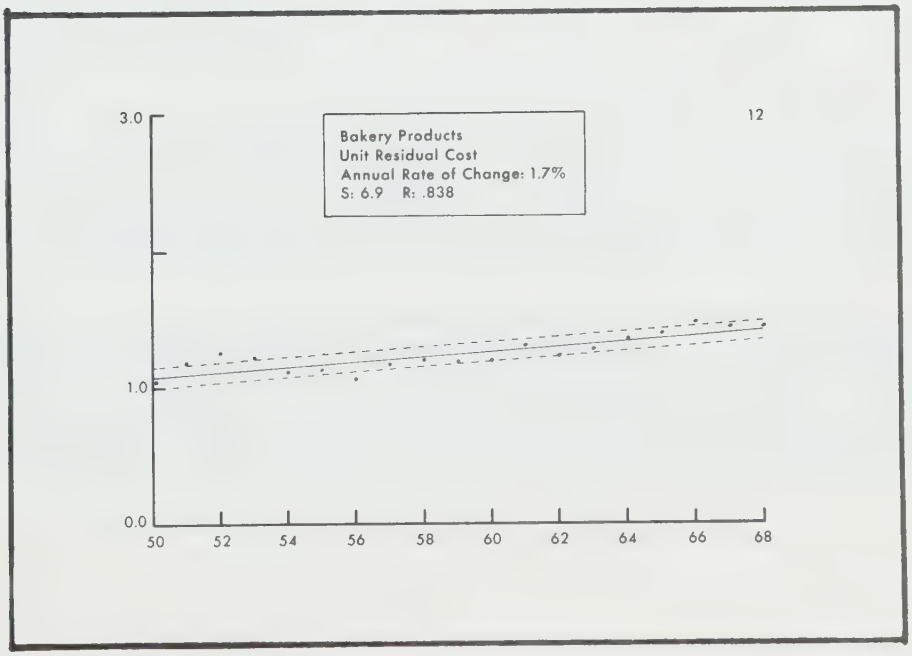

7
Bakery Products
Output per Worker
Annual Rate of Change: 2.2%
S: 3.7 R: .967
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


8
Bakery Products
Unit Labour Cost
Annual Rate of Change: 3.5%
S: 4.6 R: .977
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


9
Bakery Products
Unit Residual Cost
Annual Rate of Change: 1.9%
S: 5.7 R: .898
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


10
Bakery Products
Output per Worker
Annual Rate of Change: 2.3%
S: 3.4 R: .972
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


11
Bakery Products
Unit Labour Cost
Annual Rate of Change: 3.4%
S: 3.5 R: .984
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


12
Bakery Products
Unit Residual Cost
Annual Rate of Change: 1.7%
S: 6.9 R: .838
3.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Compensation (annual wages, annual wages and salaries) per worker moved almost exactly in line with that for all manufacturing, increasing 163.1 percent for production labour between 1949 and 1968 in the industry compared with 161.5 percent for all manufacturing and 160.1 percent for total labour compared with 166.5 percent. Over the shorter period production labour compensation increased 44.4 percent compared with an average of 43.9 percent and total labour compensation per worker by 43.4 percent compared with 45.9 percent. The trend rates over the full period were 7.4 and 7.3 percent for production and total labour respectively in the industry, compared with 7.2 and 7.5 percent for all manufacturing. However, the industry rates fell behind the average in the short period (1961-1968), 5.7 and 5.6 percent compared with 6.3 percent for both production and for total labour in all manufacturing. While annual wages per production worker increased 163.1 percent between 1949 and 1968, occupational wage rates increased more, at 178.5 percent, and average hourly earnings even more, at 184.6 percent (see Table 9A). The 1961-1968 increases in annual wages per worker, average hourly earnings and occupational wage rates were 44.5, 48.0 and 51.9 percent respectively. The reasons for these different increases are explained in general terms in Chapter Six.

Implicit (value-added) price increased at a much greater than average annual rate in this industry for both the full and short periods, 2.6 percent for the former, compared with 1.0 percent for all manufacturing, and 3.4 percent in the latter, compared with 0.9 percent. Moreover, unlike slaughtering and meat processors, the first industry analyzed, these are firm trends, with R values of .967 and .956. (The 1961-1968 trend rate based on value added by total activity, at 3.5 percent, is almost identical with the other based on value added by manufacturing only.)

The 1968 industry selling price index was 117.9 (base, 1961 = 100) for biscuit manufacturers and 121.5 for bakeries, compared with the implicit (value-added) price index of 116.5, over 1961. Since industry selling price, unlike value-added price, includes the cost of raw material and other inputs from outside the establishment, it seems that these inputs have gone up somewhat more in cost, relative to units of output, than the labour and other inputs employed in the establishment whose cost is accounted for in value-added price. The only products of this industry for which the retail price is indexed are bread (plain, white, wrapped, sliced, per pound) and soda crackers; the 1968 price index for bread was 122.5 and for soda crackers, 112.0 (based on 1961 = 100). Of course, a comparison of retail price increases for particular commodities with one value-added price index for the industry group and two industry selling price indexes is too hazardous in this case without our knowing whether bread and soda cracker price changes are representative of retail price changes for all products of the industry; which we do not know.

Labour productivity in the industry increased much less than average; for the full period it increased by 52.2 and 56.8 percent for production labour and total labour respectively, compared with 112.7 and 103.7 percent in all manufacturing (see Table 17). Over the shorter period the increases were 16.5 and 18.0 percent for production and for total labour compared with 34.6 and 24.1 percent in all manufacturing. The full-period annual trend rates of increase at 2.2 and 2.3 percent for production and total labour respectively are about 40 percent less than the rates for all manufacturing. Indeed, as the reader can observe from Table 19, both rates are the third lowest of all. The 1961-1968 trend rate for production labour at 0.8 percent is lower than for any other industry and is 78 percent less than the all-manufacturing rate of 3.7 percent; the short-period trend for total labour, at 1.4 percent, is almost twice the rate for production labour. Even so, it is 64 percent less than the all-manufacturing rate of 3.9 percent, and there are only two industries with lower rates of increase over the full period for output per worker for total labour.

Aside from the much lower than average rates of increase in output per worker, one other noteworthy feature is that over 1961-1968 the rate for total labour should be almost twice the rate for production labour only. This is not so for the full period nor for either time period for all manufacturing or for very many of the industries studied, as an examination of Table 19 reveals.

A combination of much lower than average increases in labour productivity with about average increases in compensation per worker meant much greater than average increases in unit labour cost. By 1968 production labour unit cost was 72.9 percent higher than in 1949, more than three times the increase for all manufacturing (see Table 24). Over the same period the contrast is not quite so great when total labour is taken into account, an increase of 66.0 percent for the industry, slightly more than twice the increase of 30.8 percent for all manufacturing.

In terms of trend rates, the contrast between bakery products and all manufacturing is even greater, especially for the full period; in the industry unit labour cost over 1949-1968 rose at annual rates of 3.5 and 3.4 percent for production and for total labour, compared with rates of 0.5 and 0.7 percent for all manufacturing. While the industry rates for the full period were five to seven times greater than the all-manufacturing rates, for the shorter period the difference had narrowed although they were still twice the average, 4.6 and 3.8 percent, compared with 2.0 and 1.9 percent.

It will be observed from the summary table that most of the R values for output per worker and unit labour cost for this industry are high (the exceptions are the two values for output per worker for 1961-1968), indicating a rather steady upward trend, albeit a much more modest one for productivity than for labour cost. However, an inspection of the charts and the indexes in Table 17 (output per worker) and Table 24 (unit labour cost) reveals that the trends followed a fluctuating path. Thus, for production labour, output per worker increased 9.6 percent between 1952 and 1958, accelerated to 15.4 percent between 1958 and 1962, declined slightly, by 4.4 percent, between 1962 and 1966, and increased 12.4 percent in the last two

years, 1966 to 1968. This spurt at the end is interesting in an industry where labour productivity increased over the full period much less than average. The pattern is substantially the same for total labour.

Unit labour cost also fluctuated; with respect to production labour, it increased 21.4 percent between 1952 and 1958, remained virtually unchanged from 1958 to 1962, increased 23.1 percent over the next four years, 1962 to 1966, and levelled off with a rise of only 2.3 percent between 1966 and 1968. And, of course, similar fluctuations can be discerned for unit labour cost, total labour.

Unit residual cost increased over the full period and at a greater rate over the shorter, more recent period; but the increases for unit labour cost were about twice the rate for unit residual cost except with respect to total labour for 1961-1968 where it was only one-third greater. At the same time unit residual cost increases were significantly higher in this industry than in all manufacturing, the annual trend rates for the full period in this industry being 1.9 and 1.7 percent with respect to production and total labour respectively, compared with 1.3 and 1.2 percent for all manufacturing. Over 1961-1968 the contrast is much greater, with the industry rates being 2.4 and 2.9 percent compared with 0.2 percent and minus 0.1 percent in all manufacturing. With respect to value added, total activity - the preceding data pertaining to value added, manufacturing - unit residual cost increased even more, at 3.2 percent annually between 1961 and 1968 (compared with 2.9 percent with respect to total labour and value added, manufacturing), and the total labour unit labour cost annual rate of increase at 3.8 percent, was only 16 percent higher, compared with a difference twice that much when value added by manufacturing only is accounted for.

The bakery products industry is somewhat but not substantially more labour intensive than average, the 1949 production and total labour shares of value added being 44.4 and 54.5 percent compared with 36.8 and 48.6 percent for all manufacturing. Over the full period and the short (1961-1968) period the labour share increased; over 1949-1968 the annual trend rates were 0.6 and 0.5 percent for production and for total labour compared with negative rates of -0.4 and -0.2 percent for all manufacturing. Over the 1961-1968 period there was less difference between this industry and all manufacturing, the labour shares in bakery products increasing at annual rates of 1.0 and 0.3 percent for production and for total labour respectively, compared with 1.1 and 1.0 percent in all manufacturing.

Of course, the importance of changes in factor shares should not be exaggerated. After all, an annual increase of 0.6 percent applied to a labour share of 44.4 percent (the figures for production labour, 1949-1968), means in the first year, a rise of only four-tenths of one percent. With the labour share in bakery products increasing, it follows that the residual share is declining, which is indicated in the summary table.

The composition of implicit (value-added) price change for bakery products is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(3.5	x	.444)	+	(1.9	x	.556)	=	2.6	2.6
Tot. lab., 1949-68[x]	(3.4	x	.545)	+	(1.7	x	.455)	=	2.6	2.6
Prod. lab., 1961-68[x]	(4.6	x	.463)	+	(2.4	x	.537)	=	3.4	3.4
Tot. lab., 1961-68[x]	(3.8	x	.557)	+	(2.9	x	.443)	=	3.4	3.4
Tot. lab., 1961-68[y]	(3.8	x	.569)	+	(3.2	x	.431)	=	3.5	3.5

x - related to value added by manufacturing
y - related to value added by total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

Because the labour and residual shares are close to equality (about 45 percent to 55 percent in the case of production labour and vice-versa for total labour), and because (except for total labour, 1961-1968) unit labour cost increased at about twice the rate of unit residual cost, between 60 and 70 percent of implicit (value-added) price increase consisted of a labour cost component. In the case of total labour for the short period with respect to value added, manufacturing and value added, total activity, the labour share was sufficiently larger that even though the rate of unit labour cost increase did not exceed the rate of unit residual cost increase by as much as in the other cases, the labour cost component was still about 60 percent.

Over the full period there was only one industry in which implicit (value-added) price increased more rapidly than in bakery products (see Table 16) and this is reflected in the higher than average increases in unit cost, both labour and residual. Or, it might be contended, the higher than average cost increases are reflected in the high implicit price increase. However, to repeat what has been said previously in this study, no attempt is made here to determine whether one is cause and the other, effect. By 1961-1968 conditions had changed such that six industries showed greater implicit price increases whether measured in relation to value added, manufacturing or value added, total activity.

Distilleries

Unlike the first two industries examined, foreign trade is very important for the distilling industry. In 1965, 54.5 percent of the industry's value of output was exported and imports accounted for 18.8 percent of the value of the value of market sales of the products of the industry (see Table 1). Liquor accounts for 1.3 percent of the consumer price index. Distilleries (Standard Industrial Classification code 143) cover the distilling of industrial and other alcohol, alcoholic beverages, liquors, and spirits such as whisky, brandy, rum and gin. There were no significant changes in the makeup of the industry for statistical purposes when the 1961 revised S.I.C. was introduced.

This industry experienced much greater than average increases in production and in value added over both the full and shorter periods. Over the full period only five industries among the 22 studied showed larger increases in production and four industries over the shorter period, and over both periods only four industries showed larger increases in value added by manufacturing. Increases in production of 266.4 and 86.2 percent over the full and short periods respectively compare with 170.6 and 61.1 percent for all manufacturing (see Table 2). Increases in value added (manufacturing activity only) of 374.6 and 94.7 percent compare with 259.9 and 71.0 percent for all manufacturing. The difference narrowed in the more recent period, the industry production increase exceeding that for all manufacturing by 56 percent in the full period and 41 percent in the short period, increases in value added exceeding that for all manufacturing by 44 percent in the full period and 33 percent in the short period.

The higher than average increases in production and in value added were accompanied by smaller than average increases in production labour employment while total labour employment increased over the full period by about the same amount as in all manufacturing but by somewhat less over the short period. Production labour employment in 1968 was only 5.4 percent greater than in 1949, compared with an increase of 27.2 percent in all manufacturing; total employment was 31.0 percent higher, compared with 32.8 percent for all manufacturing (see Table 3). Over the shorter (1961-1968) period production labour employment increased 6.6 percent compared with 19.7 percent for all manufacturing and total employment, 20.4 percent compared with 29.8 percent.

The reason production labour employment increased more (6.6 percent) between 1961 and 1968 than between 1949 and 1968 (5.4 percent) is that employment in 1961 had dropped to 94.4 percent of its 1949 level. Table 3 shows that production labour employment in 1956 was 42.1 percent higher than in 1949; by 1964 it was 36 percent less than the 1956 high, and between 1964 and 1968 the employment of production labour went up 16 percent. While there were also fluctuations in the employment of the total labour force, the upward trend was steadier and stronger.

The proportion of total employment accounted for by production labour declined from 76.7 percent in 1949 to 61.7 percent in 1968, a reduction of 19.6 percent, working out to an annual trend rate of decline of -1.2 percent (see Table 5), which is the largest rate of decline for any of the industries studied. By 1968 there were only two industries with a smaller proportion of production workers in their labour force, and the 61.7 percent for this industry in that year compares with 77.7 percent for all manufacturing.

Compensation (annual wages, annual wages and salaries) per production worker increased 197.6 percent over the full period and 45.5 percent over the short period, compared with 161.5 and 43.9 percent for all manufacturing. With respect to total labour (annual wages and salaries per worker) the increases were 180.1 and 41.0 percent compared with 166.5 and 45.9 percent for all manufacturing. Production workers fared better than average over the full period although not over the short period, and nonproduction workers (the other component of total labour) only slightly, if at all, better than average. This can be seen more clearly from the annual trend rates of increase, which for the full period are 10.2 and 10.1 percent for production and total labour respectively, compared with 7.2 and 7.5 percent for all manufacturing, while the short-period rate of 6.7 percent for production labour is only a little higher than the average of 6.3 percent, while the rate for total labour at 6.1 percent is a little less than the average which is also 6.3 percent.

Implicit (value-added) price increased 29.5 percent between 1949 and 1968, a little less than the 33.0 percent for all manufacturing, and the 1961-1968 increase of 4.6 percent is also just a little less than the 6.2 percent average (see Table 12). However, over the short period implicit price related to value added, total activity increased 5.1 percent or only half as much as the 10.5 percent for all manufacturing. The industry selling price index for distilleries was 10.2 percent higher in 1968 than in 1961, compared with implicit (value-added) price increases of 4.6 and 5.1 percent, as just described. Over the same period the consumer (retail) price index for liquor increased 23.9 percent. Thus, only half of the wholesale (i.e. industry selling) price increase and about 20 percent of retail price increase can be attributed to higher price at the level of the establishment (value-added price).

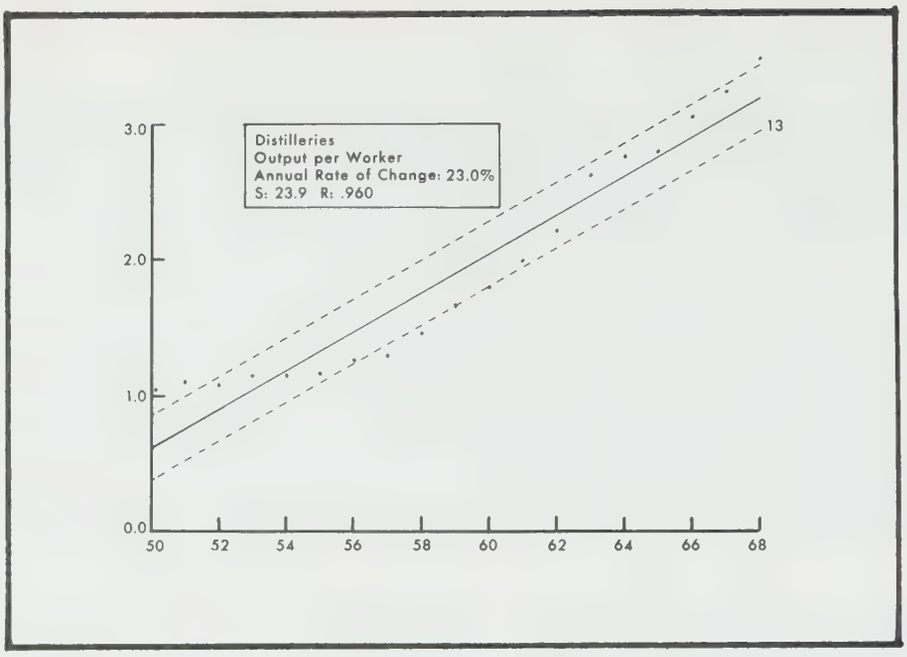
The annual trend rate of increase in implicit (value-added) price was 0.9 percent for the full period, compared with 1.0 percent for all manufacturing, and 1.1 percent for the short period, compared with 0.9 percent. This industry and all manufacturing were closely in line except for implicit price related to value added, total activity where the rate of increase in this industry for 1961-1968 was 1.1 percent, as with value added, manufacturing, but was notably less than the 1.7 percent rate for all manufacturing.

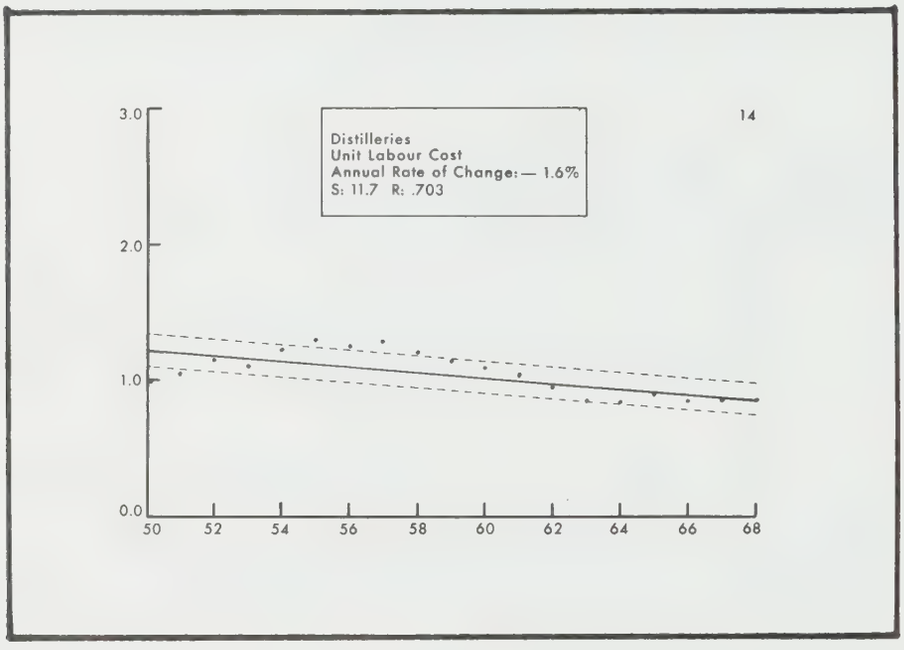
DISTILLERIES

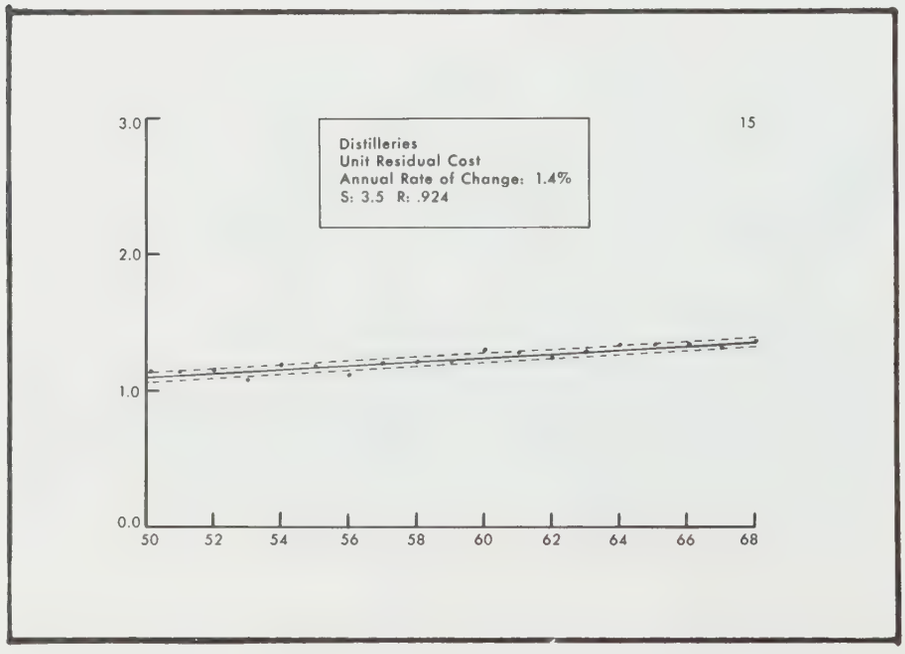
Summary Table – Principal Statistics

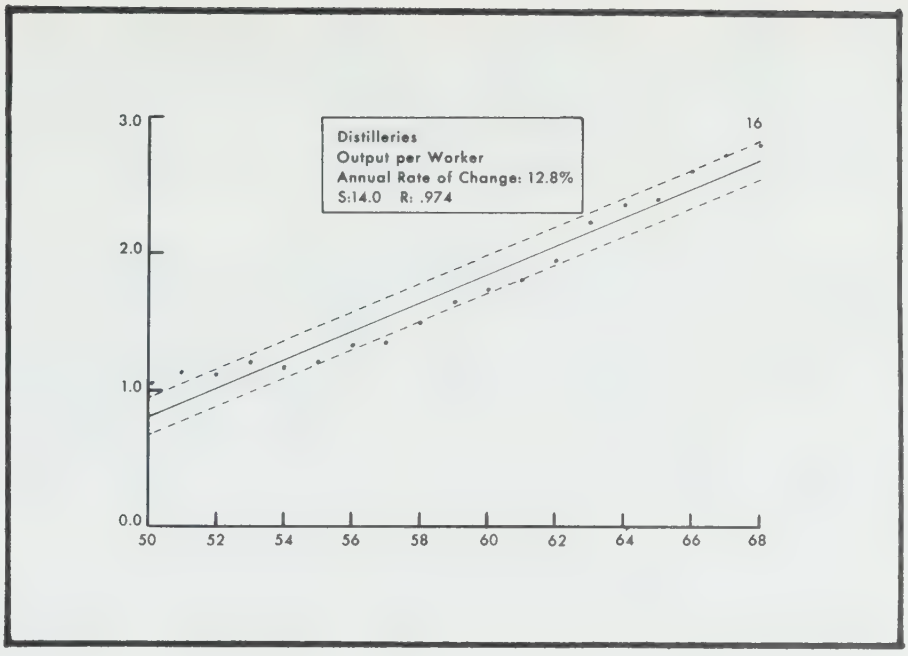
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			366.4			186.2			
Index of value added (1949 or 1961 = 100)			474.6			194.7		195.7	
Index of employment (1949 or 1961 = 100)	105.4	131.0		106.6	120.4				
Index of compensation per worker (1949 or 1961 = 100)	297.6	280.1		145.5	141.0				
Annual trend rate, compensation per worker	+10.2%	+10.1%		+6.7%	+6.1%				
Implicit, value-added price – index, 1949 or 1961 = 100)			129.5			104.6		105.1	
– Annual trend rate of change			+0.9%			+1.1%		+1.1%	
– R value			.884			.836		.848	
Output per worker – index, 1949 or 1961 = 100	347.6	279.8		174.8	154.7				
– Annual trend rate of change	+23.0%	+12.8%		+8.2%	+6.7%				
– R value	.960	.974		.983	.981				
Unit labour cost – index, 1949 or 1961 = 100	85.6	100.1		83.2	91.1				
– Annual trend rate of change	–1.6%	–0.5%		–1.1%	–0.5%				
– R value	.703	.461		.574	.316				
Unit residual cost – index, 1949 or 1961 =100	136.7	137.4		107.4	107.7		108.4		
– Annual trend rate of change	+1.4%	+1.3%		+1.3%	+1.4%		+1.5%		
– R value	.924	.918		.861	.843		.847		
Payroll as a proportion of value added 1949	14.1%	21.1%							
1961				11.7%	18.7%		19.1%		
1968	9.3%	16.3%					16.6%		
Trend rate of change in labour share	–2.1%	–1.1%		–2.1%	–1.6%		–1.6%		
– R value	.822	.826		.760	.666		.681		
Trend rate of change in residual share	+0.4%	+0.3%		+0.3%	+0.4%		+0.3%		

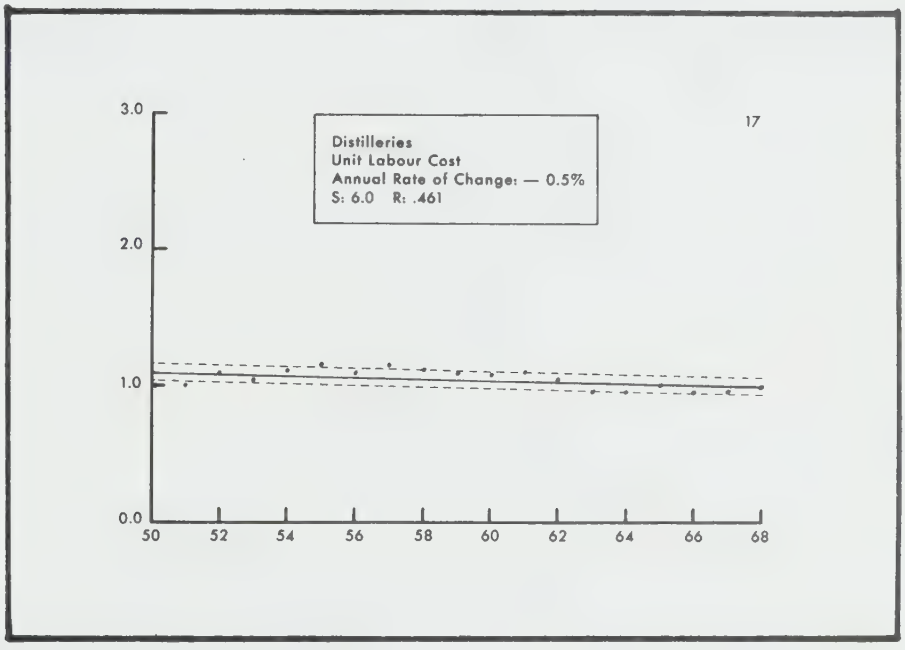
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

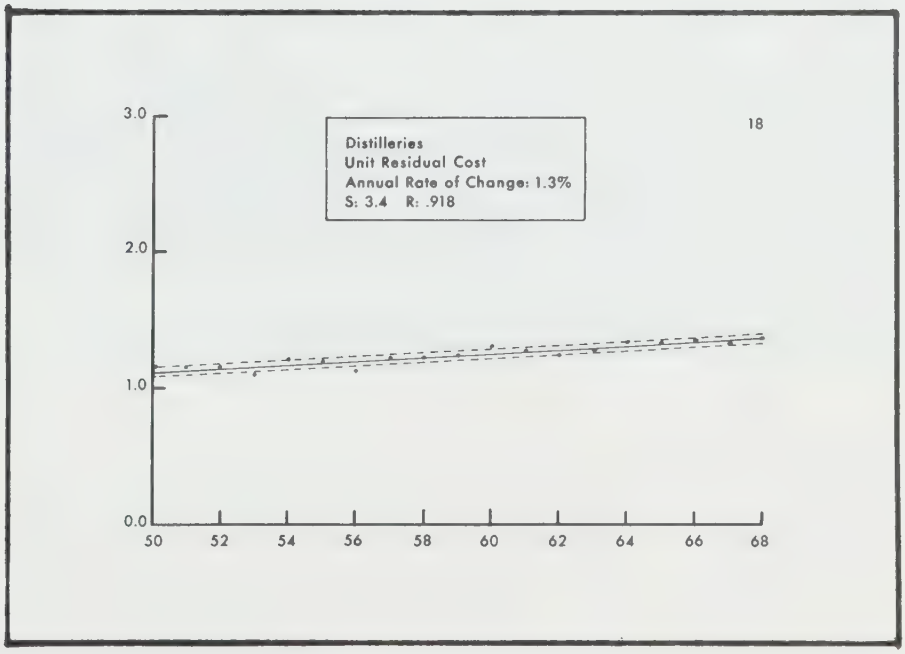

Distilleries
Output per Worker
Annual Rate of Change: 23.0%
S: 23.9 R: .960
13
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Distilleries
Unit Labour Cost
Annual Rate of Change: — 1.6%
S: 11.7 R: .703
14
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Distilleries
Unit Residual Cost
Annual Rate of Change: 1.4%
S: 3.5 R: .924
15
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Distilleries
Output per Worker
Annual Rate of Change: 12.8%
S:14.0 R: .974
16
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Distilleries
Unit Labour Cost
Annual Rate of Change: — 0.5%
S: 6.0 R: .461
17
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Distilleries
Unit Residual Cost
Annual Rate of Change: 1.3%
S: 3.4 R: .918
18
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

With such large increases in output and such modest increases in employment, impressive gains in labour productivity are to be expected, which is indeed the case. Increases over the full period of 247.6 percent and 179.8 percent in output per worker for production and total labour respectively compare with 112.7 and 103.7 percent for all manufacturing; and increases over the short period of 74.8 and 54.7 percent compare with 34.6 and 24.1 percent. Only two of the industries studied showed greater increases between 1949 and 1968, but there were five such industries for 1961 to 1968 (see Table 18).

The 1949-1968 annual trend rate of increase of 23.0 percent for production labour is exceeded by only one industry (see Table 19) and the rate over the same period for total labour of 12.8 percent is also exceeded by only one industry. These rates of 23.0 and 12.8 percent compare with 5.9 and 5.8 percent for all manufacturing. Over the more recent (1961-1968) period the rates of increase, while still substantial, had moderated considerably. They were 8.2 and 6.7 percent for production and total labour respectively compared with 3.7 and 3.9 percent for all manufacturing. The pattern was for most of the industries studied to register smaller rates of increase in output per worker over the 1961-1968 period than over the full period but the reduced rate is especially remarkable in distilleries. For the full period the two rates were 290 and 121 percent higher than the comparable all-manufacturing rates but for the shorter period the differences were 122 and 72 percent. But even in 1961-1968 only one of the industries studied had a higher annual rate of increase in output per production worker and only two industries in the case of total labour.

Exceptional increases in labour productivity, combined with increases in compensation per worker that over the full period were not as exceptional and, during the short period, were just about average, meant that unit labour cost would decrease. For the full period it declined by a trend rate of -1.6 percent per annum with respect to production labour and -0.5 percent for total labour; these compare with rates of increase of 0.5 and 0.7 percent for all manufacturing. Because of the fluctuations in unit labour cost, despite an annual rate of decline of -0.5 percent with respect to total labour, the index for 1968 was, at 100.1, virtually the same as for the base year, 1949. Inspection of the charts reveals, as do the R values, that the downward trend was stronger with respect to production labour than it was for total labour. Over the more recent period the rate of decline in unit labour cost moderated to -1.1 percent per annum from -1.6 percent over the full period, for production labour; but the rate of decline with respect to total labour, at -0.5 percent, did not change.

In this industry unit residual cost moved in the opposite direction from unit labour cost and at about the same annual rate in both the full and short periods. While unit labour cost (production labour) was 14.4 percent less in 1968 than 1949, unit residual cost was 36.7 percent greater; with respect to total labour, as noted above, unit labour cost showed no change but unit residual cost was 37.4 percent greater (see Table 28). The annual trend rates of increase in unit residual cost are 1.4 and 1.3 percent with respect to production and total labour respectively over the full period, quite similar to the rates of 1.3 and 1.2 percent for all manufacturing. The annual trend rates for the industry are virtually the same for the short period, at 1.3 and 1.4 percent, and a comparison with all manufacturing is not made because its short-period trend rates are without statistical significance.

Because of the steady rise in unit residual cost associated with a steady decline in unit labour cost, the labour share declined not only over the full period, which is also what happened in all manufacturing, but also over the more recent, shorter period when the labour share increased in all manufacturing. The distilleries industry is the least labour intensive of all the industries studied, with 1949 labour shares of 14.1 and 21.1 percent for production and total labour respectively, none of the other industries having such low figures for that year. It is interesting that in spite of such a small labour share, it was still declining. Of course, as has been said elsewhere, a reduction of 2.1 percent per annum, applied to 14.1 percent (the rate and share for production labour), amounts to only 0.3 in the first year and becomes less each year thereafter. Nevertheless, the production labour share was down to 9.3 percent in 1968 from 14.1 percent in 1949 and to 16.3 percent from 21.1 percent for total labour. The residual share had to increase since the labour share was declining, and because the residual share was much larger to begin with, the annual rates of increase would be much smaller than the rates of decrease for the labour share, which can be seen from the summary table.

Decided fluctuations in productivity and unit cost can be observed from the charts. To turn only to output per worker and unit labour cost with respect to production labour, there was an increase in output per worker of 24.6 percent between 1950 and 1957, followed by an extraordinary 101.2 percent rise between 1957 and 1963 and a more modest (for this industry) 33.2 percent between 1963 and 1968. Unit labour cost increased 27.4 percent between 1950 and 1957, declined 33.2 percent between 1957 and 1963, and in effect stood still between 1963 and 1968, showing an increase of only 0.2 percent. Because of these fluctuations, it was found that better fitting values (i.e. a trend line with a higher R value) could be obtained from a nonlinear than a linear function for unit labour cost with respect to total labour for both the full and short periods. (For the details see Appendix C.)

The composition of implicit (value-added) price for the distilleries industry is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-1.6	x	.141)	+	(1.4	x	.859)	=	1.0	0.9
Tot. lab., 1949-68[x]	(-0.5	x	.211)	+	(1.3	x	.789)	=	0.9	0.9
Prod. lab., 1961-68[x]	(-1.1	x	.117)	+	(1.3	x	.883)	=	1.0	1.1
Tot. lab., 1961-68[x]	(-0.5	x	.187)	+	(1.4	x	.813)	=	1.0	1.1
Tot. lab., 1961-68[y]	(-0.5	x	.191)	+	(1.5	x	.809)	=	1.1	1.1

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

In each case all of the increase in implicit (value-added) price consists of unit residual cost with the reduction in unit labour cost meaning that implicit price rose less than it would have in the absence of such a reduction. For example, in the first equation, if unit labour cost had followed zero change, implicit price would have risen 1.2 percent (which is 1.4 x .859) instead of 1.0 percent.

Breweries

The product of this industry is not important as an export or an import. In 1965 only 1.5 percent of the Canadian industry's value of output was exported and imports of brewery products made up only 0.8 percent of the value of total market sales (see Table 1). However, the product is important in the domestic market, with beer accounting for 2.6 percent of the consumer price index. Breweries (Standard Industrial Classification code 145) comprise establishments primarily engaged in manufacturing ale, beer, malt liquors and related beverages. No changes of importance were made in the commodities constituting the output of the industry with the introduction of the revised S.I.C. code in 1960.

Although the industry's output and value added increased less than average, output per worker increased more than average (with an exception noted below), unit labour cost, for the most part, increased less than average, while unit residual cost, for the most part, increased more than average. Changes in factor shares and trends in implicit (value-added) price followed a mixed pattern.

Production in 1968 was 100.8 percent greater than in 1949, compared with an increase of 170.6 percent for all manufacturing. Between 1961 and 1968 the increase for breweries was 27.6 percent compared with 61.1 percent for all manufacturing (see Table 2). The difference between the two increased from about 40 percent for the full period to 55 percent for the short period. Value added (manufacturing activity) was 167.4 percent greater in 1968 than in 1949, compared with an increase of 259.9 percent in all manufacturing; over the short period the industry increase was 37.6 percent compared with 71.0 percent for all manufacturing. As with production, the difference was greater in the more recent period than over the full period, 36 percent and 47 percent.

While employment increased in most of the industries studied and in all manufacturing, in this industry it declined for both production and total labour and over both time periods. The reduction of 27.7 percent in production worker employment between 1949 and 1968 contrasts with an increase of 27.2 percent for all manufacturing, while total employment dropped 13.2 percent compared with an all manufacturing increase of 32.8 percent (see Table 3). Between 1961 and 1968 production worker employment dropped 9.7 percent but total employment held almost steady with a reduction of only 1.5 percent, compared with all manufacturing increases of 19.7 and 29.8 percent for production and total labour respectively. There were only five industries in addition to breweries, among those studied, that showed a decline in employment (both production worker and total) and only two that showed a greater reduction than this industry.

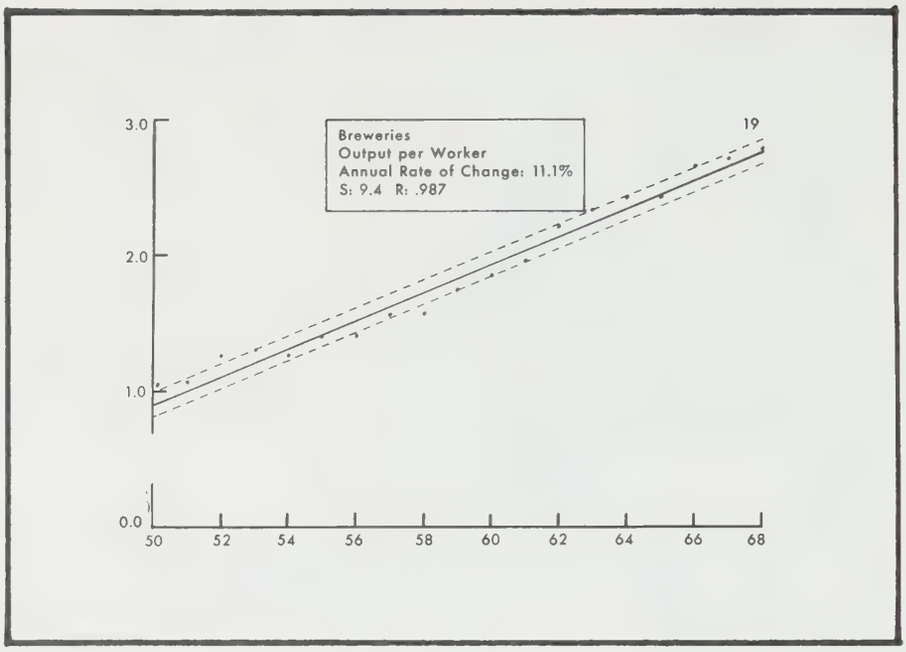
There was a substantial shift in the proportions of production and nonproduction workers employed, the production worker proportion dropping by 16.7 percent from 81.0 percent in 1949 to 67.5 percent in 1968 (see Table 5). There was an annual trend rate of decline of -0.9 percent which, it might be noted, had high statistical significance with an R value of .97. This annual rate of decline in the production worker proportion was much greater than the rate of decline of -0.1 percent for all manufacturing. The 16.7 percent reduction between 1949 and 1968 greatly exceeded the 4.2 percent reduction for all manufacturing, in fact, in only three industries was the reduction greater over this period. While the production worker proportion in 1949 at 81.0 percent was almost perfectly in line with that for all manufacturing, the 1968 proportion of 67.5 percent was much less than the all manufacturing 77.7 percent. And there were only four industries with smaller proportions of production workers.

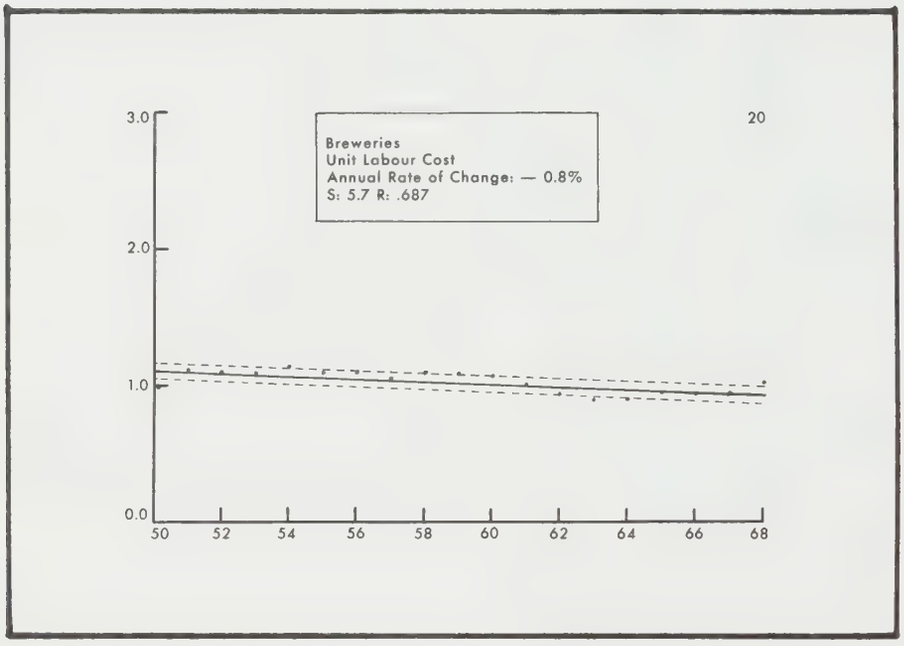
BREWERIES

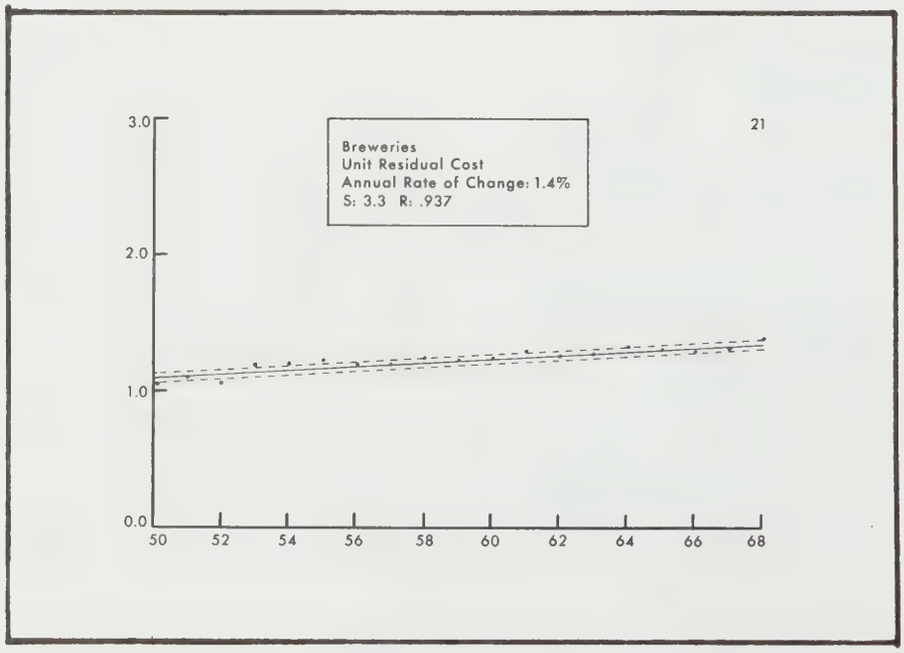
Summary Table – Principal Statistics

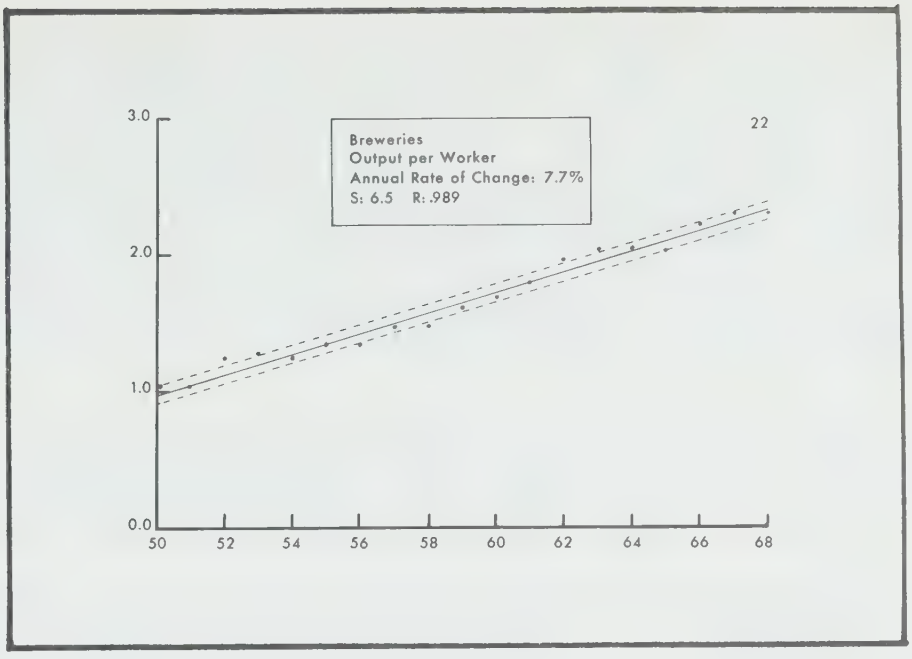
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			200.8			127.6			
Index of value added (1949 or 1961 = 100)			267.4			137.6		138.8	
Index of employment (1949 or 1961 = 100)	72.3	86.8		90.3	98.5				
Index of compensation per worker (1949 or 1961 = 100)	284.1	284.0		143.1	143.6				
Annual trend rate, compensation per worker	+8.1%	+8.2%		+6.2%	+6.4%				
Implicit, value-added price – index, 1949 or 1961 = 100			133.1			107.8		108.7	
– Annual trend rate of change			+1.0%			+1.4%		+1.3%	
– R value			.891			.837		.855	
Output per worker – index, 1949 or 1961 = 100	277.8	231.4		141.4	129.6				
– Annual trend rate of change	+11.1%	+7.7%		+4.3%	+3.2%				
– R value	.987	.989		.981	.932				
Unit labour cost – index, 1949 or 1961 = 100	102.3	122.7		101.2	110.8				
– Annual trend rate of change	–0.8%	+0.2%		+1.3%	+2.6%				
– R value	.687	.206		.693	.925				
Unit residual cost – index, 1949 or 1961 = 100	139.5	136.3		108.8	107.0		108.2		
– Annual trend rate of change	+1.4%	+1.3%		+1.3%	+0.9%		+1.0%		
– R value	.937	.911		.840	.720		.739		
Payroll as a proportion of value added 1949	17.0%	23.0%							
1961				13.9%	20.6%		21.7%		
1968	13.0%	21.2%					22.1%		
Trend rate of change in labour share	–1.6%	–0.7%		0.0%	+1.1%		+1.2%		
– R value	.928	.768		.022	.779		.783		
Trend rate of change in residual share	+0.3%	+0.2%		0.0%	–0.3%		–0.3%		

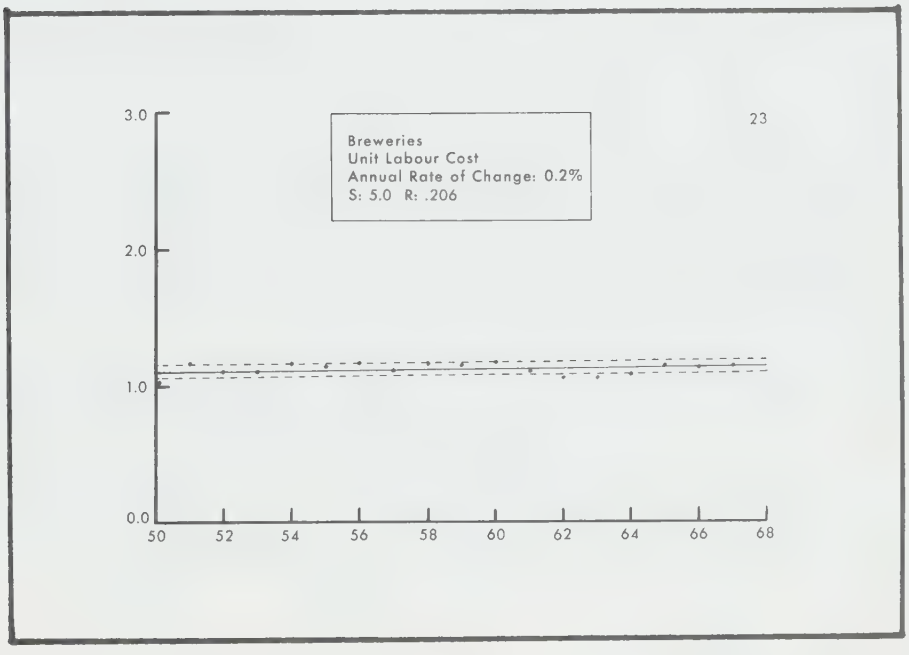
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

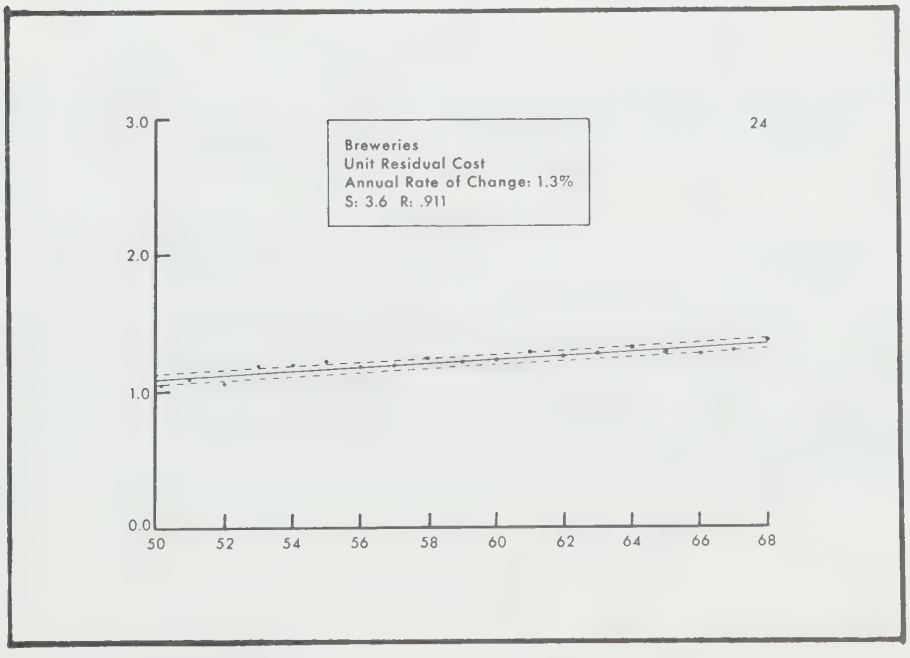

Breweries
Output per Worker
Annual Rate of Change: 11.1%
S: 9.4 R: .987
19
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Breweries
Unit Labour Cost
Annual Rate of Change: — 0.8%
S: 5.7 R: .687
20
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Breweries
Unit Residual Cost
Annual Rate of Change: 1.4%
S: 3.3 R: .937
21
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


22
Breweries
Output per Worker
Annual Rate of Change: 7.7%
S: 6.5 R: .989
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


23
Breweries
Unit Labour Cost
Annual Rate of Change: 0.2%
S: 5.0 R: .206
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


24
Breweries
Unit Residual Cost
Annual Rate of Change: 1.3%
S: 3.6 R: .911
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68

Compensation (annual wages, annual wages and salaries) per worker increased somewhat more than average over the full period and just about in line with the average over the short period. Production labour and total labour compensation per worker increased at the same extent, 184.1 percent and 184.0 percent, in the full period, and by 43.1 and 43.6 percent over the short period. The full-period annual trend rates of increase were 8.1 and 8.2 percent for production and total labour respectively, compared with 7.2 and 7.5 percent for all manufacturing; over the short period the rates, at 6.2 and 6.4 percent, were closely in line with the all-manufacturing rate of 6.3 percent for both labour groups. The increase between 1949 and 1968 of 184.1 percent in annual wages per worker was a little less than the increases of 194.3 and 195.2 percent in average hourly earnings and occupational wage rates (see Table 9A); however, between 1961 and 1968 annual wages per worker increased the most, 43.1 percent, compared with 34.6 and 35.6 percent. Annual earnings may increase less because of time lost without pay during the year because of layoffs or strikes, while average hourly earnings may increase more if there is a lot of premium-paid overtime work or if there is an increase in the proportion of the more highly paid workers. This is discussed in general terms in Chapter Six.

Over the full period implicit (value-added) price in the industry behaved just like that for all manufacturing. It was 33.1 percent greater in 1968 than in 1949, compared with 33.0 percent for all manufacturing, and the annual trend rate of increase, at 1.0 percent, was the same for both. But the industry rate of change was greater than average over the short period; while the industry implicit price was 7.8 percent greater in 1968 than in 1949, only a little in excess of the 6.2 percent for al manufacturing, the annual rate, at 1.4 percent, was notably greater than the 0.9 percent for all manufacturing.

The 1968 industry selling price index for breweries was 9.1 percent higher than in 1961, compared with an increase of 7.8 percent in the implicit (value-added) price. Over the same period the consumer (retail) price index for beer rose 12.2 percent. There were, therefore, elements of price increase at the processing, wholesale, and retail levels since each increase was somewhat greater than the previous one. However, the implicit price index for value added by total activity showed a greater increase over the same period, at an annual rate of 1.7 percent compared with 0.9 percent with respect to value added by manufacturing, and a 1968 figure 10.5 percent higher than in 1949 compared with 6.2 percent for the other measure. However, most of the additional activities going into value added by total activity over and above manufacturing activity are not covered by industry selling, wholesale or retail price indexes.

Productivity increases in this industry were higher for both categories of labour than the increases in all manufacturing, and all the trend rates but one were also higher than average. Output per production worker in 1968 was 177.8 percent greater than in 1949, compared with 112.7 percent for all manufacturing; with respect to total labour it was 131.4 percent greater compared with an average of 103.7 percent (see Table 17). Whereas in all manufacturing there was little difference between production labour and total labour productivity increases, in this industry the greater increase was clearly with respect to production labour only. The full-period annual trend rates of increase were 11.1 and 7.7 percent for production and total labour respectively, compared with 5.9 and 5.8 percent for all manufacturing.

Over the shorter period industry performance was closer to that for all manufacturing and the differences between production and total labour were less pronounced. Output per production worker was 41.4 percent greater in 1968 than in 1949, compared with 34.6 percent for all manufacturing, and the increases for total labour were 29.6 and 24.1 percent respectively. The annual trend rates for the short period were 4.3 percent for production labour, compared with 3.7 percent for all manufacturing, and 3.2 percent for total labour, compared with an average of 3.9 percent. For total labour productivity over the short period increased less than average, while the production labour margin over that for all manufacturing was considerably less than it was over the full period. The extent to which the annual rate of increase for breweries exceeded or was less than the average is as follows:

1949–1968, production labour, +88.1 percent
1949–1968, total labour, +32.8 percent
1961–1968, production labour, +16.2 percent
1961–1968, total labour, -17.9 percent.

As can be seen from the high R values, the trends had a good fit. Nevertheless, inspection of the charts shows some fluctuations in the increase of output per worker. Looking only at production labour, we note an increase of 24.9 percent in the six years from 1952 to 1958, followed by more than double that increase, 54.5 percent, over the next six years; there was a substantial increase between 1965 and 1966 followed by smaller increases in 1967 and 1968.

Based on a comparison of 1968 with 1949 and 1961, unit labour cost did not increase as much in the brewing industry as it did in all manufacturing, but the comparison is rather different when based on annual trend rates. Unit labour cost with respect to production labour remained almost constant over the entire period, as an inspection of the chart reveals; it was 2.3 percent higher in 1968 than in 1949 compared with an increase of 23.0 percent for all manufacturing. For production labour, the index for this industry was below the 1949 value for the years 1962 to 1967 inclusive (see Table 24) and since there was an almost steady decline in unit labour cost from 1955 (the high point) to 1964 (the low point), the result was a rate of decline in the annual trend rate over the full period, namely -0.8 percent, which compares with a rate of increase of 0.5 percent for all manufacturing. But because of a steady increase in unit labour cost from 1964 to 1968, and with the 1968 figure 1.2 percent higher than that for 1961, there was an annual rate of increase of 1.3 percent in production labour unit labour cost between 1961 and 1968, but this is still less than the all-manufacturing rate of increase of 2.0 percent over the same period.

For total labour there was less contrast between this industry and all manufacturing; unit labour cost increased 22.7 percent for breweries and 30.8 percent for all manufacturing, and over the short period 10.8 percent compared with 17.6 percent. However, the full-period annual trend rate of increase of 0.2 percent is not significant with R .206. Over the short period the rate is significant and is 2.6 percent compared with 1.9 percent for all manufacturing.

Unit residual cost increased considerably more than unit labour cost for both categories of labour over the full period, at the same rate as unit production labour cost over the short period and much less than unit (total labour) cost, the latter being true whether unit residual cost is related to value added by total activity or by manufacturing activity.

While unit production labour cost was at about the same level in 1968 as in 1949, unit residual cost with respect to production labour was 39.5 percent greater, which is in line with all manufacturing where the difference was 38.9 percent (see Table 28). With respect to total labour, over the full period, while unit labour cost increased 22.7 percent, unit residual cost increased 36.3 percent, also closely in line with all manufacturing where it increased 35.1 percent.

The considerable shift of employment to nonproduction labour, noted earlier, explains why unit labour cost increased with respect to total labour and declined with respect to production labour and why unit residual cost with respect to production labour (when nonproduction labour is part of residual cost) increased more than when related to total labour. This also applies to the short (1961-1968) period as well.

Over the full period the annual trend rates of increase in residual cost at 1.4 and 1.3 percent for production and total labour respectively were close to the 1.3 and 1.2 percent for all manufacturing. Over the short period, the rate with respect to production labour, at 1.3 percent, was little changed from the full-period rate, but the rate with respect to total labour was down to 0.9 percent, from 1.3 percent over the full period.

In all these measure, implicit (value-added) price, output per worker, unit labour cost and unit residual cost, the one general observation that can be made about the brewing industry is that its performance is not greatly out of line in most respect from all manufacturing, or from most of the industries studied.

Over the full period the production labour share declined from 17.0 percent in 1949 to 13.0 percent in 1968, an annual trend rate of decline of -1.6 percent, which is a greater rate of decline than the all-manufacturing rate of -0.4 percent. However, in this respect the breweries are exceptional; except for distilleries, their production labour share in 1949 was lower than for any of the other industries studied and less than half the 36.8 percent for all manufacturing. Again with the exception of distilleries, the total labour share, at 23.0 percent in 1949, was lowest, and yet it declined at an annual rate of -0.7 percent, compared with -0.2 percent for all manufacturing. By 1968 the total labour share was 21.2 percent for the industry compared with 47.8 percent for all manufacturing. The situation was different in the short period, with the production labour share remaining fairly constant (a zero annual trend rate of change) and the total labour share increasing somewhat. This switch from a decline in the labour share over the full period to an increase (at least for total labour) in the short period is consistent with the behaviour of all manufacturing. The reader must, however, be cautioned against drawing too much significance from changes in such small labour shares as are found in this industry.

The composition of implicit (value-added) price in the brewing industry is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-0.8	x	.170)	+	(1.4	x	.830)	=	1.0	1.0
Tot. lab., 1949-68[x]	(0.2	x	.230)	+	(1.3	x	.770)	=	1.0	1.0
Prod. lab., 1961-68[x]	(1.3	x	.139)	+	(1.3	x	.861)	=	1.3	1.4
Tot. lab., 1961-68[x]	(2.6	x	.206)	+	(0.9	x	.794)	=	1.3	1.4
Tot. lab., 1961-68[y]	(2.6	x	.217)	+	(1.0	x	.783)	=	1.3	1.3

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

Except for the full period with respect to production labour, both forms of unit cost were part of the implicit price incease. In the first equation, with unit labour cost declining at -0.8 percent per annum, it means that implicit price rose at an annual rate of 1.0 percent instead of 1.2 percent if unit labour cost had neither increased nor decreased over the period. Over the full period unit residual cost with respect to total labour was much the greater component of implicit price not only because of its greater rate of increase (1.3 compared with 0.2) but also because of its greater weight (.770 compared with .230). This continued to be the case over the short period with respect to production labour because while the rates of increase were

identical, the residual weight was much larger (.861 compared with .139). Even where unit labour cost increased at a greater rate, as in the last two equations, the residual cost was a greater component because of its much larger weight.

A study of labour productivity in breweries and two other industries was published by the Dominion Bureau of Statistics in 1966 covering 1947 to 1961.[11] Anyone with a special interest in productivity in breweries should consult it because it contains data not only on output per worker but also on output per manhour which, for reasons stated earlier, this study lacks; as well, it contains data on capital expenditures as well as information on general characteristics of the industry and its products not given here. On the other hand, neither this nor other studies by Statistics Canada (formerly D.B.S.) contain data on unit residual cost, implicit (value-added) price, or changes in factor shares, and only one of those published to date includes information on unit labour cost. Their output-per-worker data for breweries will not be the same as in this study for the years both studies cover because real output data have been revised since the D.B.S. report was published in December 1966.

Tobacco products

While foreign trade looms somewhat larger in this industry than in many of the others studied, it is not of great importance. On the basis of 1965 statistics especially computed for this study, 9.2 percent of the value of the industry's output was exported, while 3.0 percent of the value of total market sales consisted of imports (Table 1). As a measure of its importance to the consumer market - and this industry produces directly for the consumer - 2.6 percent of the consumer price index covers cigarettes and cigarette tobacco.

The tobacco products industries (Standard Industrial Classification codes 151, 153) cover grading, processing and packing of leaf tobacco and the manufacture of chewing tobacco, cigars, cigarettes, snuff and other tobacco products. The introduction of the new S.I.C. in 1960 carried with it no changes that would affect, for purposes of this study, the component activities of the industry.

Production increased less than average over both the full and short periods. Between 1949 and 1968 the industry's performance was not far behind average, an increase of 145.6 percent, compared with 170.6 percent for all manufacturing, and there were nine industries among those studied where production increased less (see Table 2). However, between 1961 and 1968 only two of the industries registered smaller increases, and the increase for tobacco products of 15.7 percent falls considerably behind the 61.1 percent for all manufacturing.

As with production, value added increased less than average over both time periods and was less below average over the full period than over the short period. Over the full period value added increased 199.1 percent, compared with 259.9 percent for all manufacturing, and eight industries of 21 (smelting and refining excluded) registered smaller increases; but over the short period value added increased 33.6 percent, compared with 71.0 percent for all manufacturing, a more substantial difference than obtained over the full period, and only three industries out of the 22 studied registered smaller increases. The performance of value added by total activity over the short period is similar to that of value added by manufacturing.

Employment of both production and total labour declined over both the full and short periods, compared with an increase for all manufacturing (see Table 3). Over the full period production worker employment either declined less or increased in all but four of the other industries studied; that is, there were only four industries where the reduction in production worker employment was greater. In the case of total labour over the full period there were only two such industries, while over the short period for production labour there were three such industries and two for total labour. This reduction in employment is partly a result of the less than average increase in production and partly because of the greater than average increases in labour productivity, which are discussed presently.

The proportion of production workers to total employment dropped from 86.4 percent to 81.4 percent between 1949 and 1968, a drop of 5.8 percent, or at an annual trend rate of -0.2 percent (see Table 5). There are 11 industries among those studied where the proportion dropped more between the two years but the reduction of 5.8 percent is greater than the 4.2 percent drop for all manufacturing (see Table 5). However, at 81.4 percent, the production worker proportion in 1968 was greater than the average of 77.7 percent, but six of the industries studied had larger proportions.

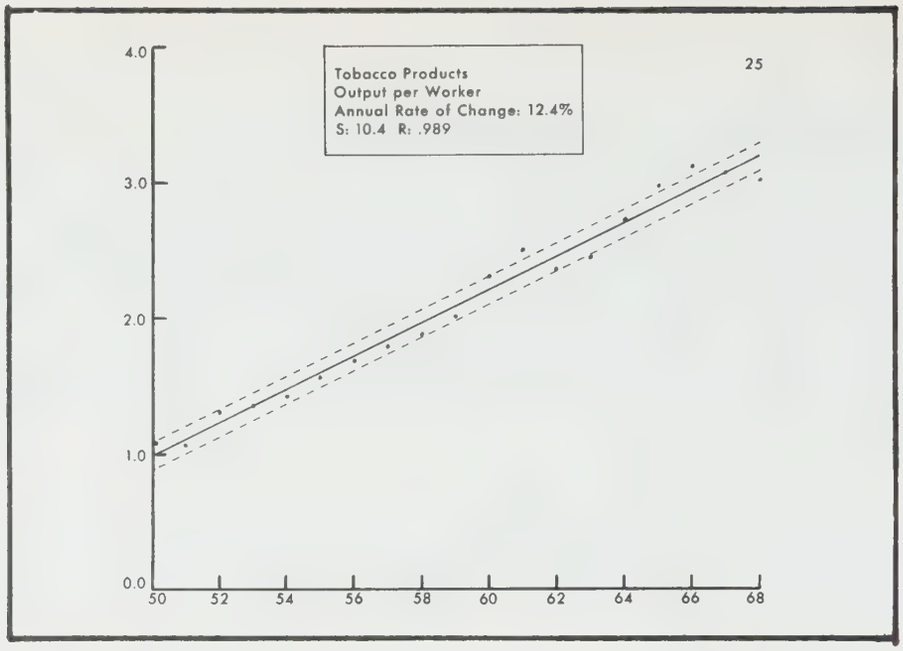
Compensation (annual wages, annual wages and salaries) per worker, for both categories of labour, increased significantly more than average over the full period, while the percentage difference between 1961 and 1968 was about in line with the average although the short-period trend rates, just like those for the full period, were above average. Between 1949 and 1968 compensation per production worker increased 198.2 percent, compared with 161.5 percent for all manufacturing, or at an annual trend rate of 8.7 percent compared with 7.2 percent, while compensation per worker for all labour increased 201.1 percent compared with an average of 166.5 percent, or at an annual rate of 8.8 percent, compared with 7.5 percent. Compensation per production worker increased 47.0 percent over the short period, compared with 43.9 percent for all manufacturing, or at an annual rate of 8.1 percent compared with 6.3 percent, while on a total labour basis the increase was 48.8 percent compared with 45.9 percent, or an annual rate of 8.2 percent compared with 6.3 percent. While the rate of increase had slowed down in the 1961-1968 period both for tobacco products and for all manufacturing, the rate dropped more for the latter, so that the margin by which the rate of increase in compensation per worker in this industry exceeded

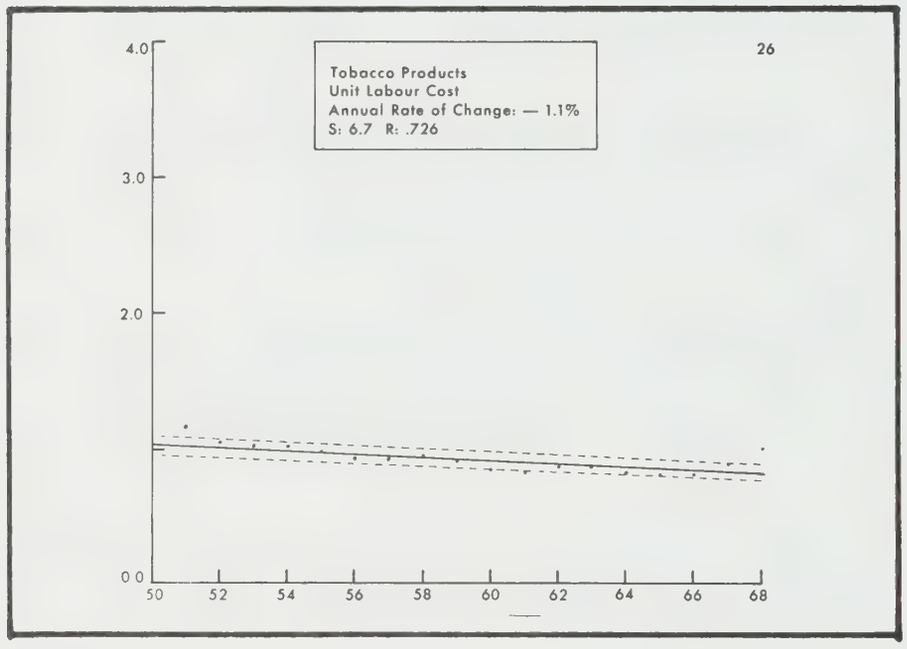
TOBACCO PRODUCTS

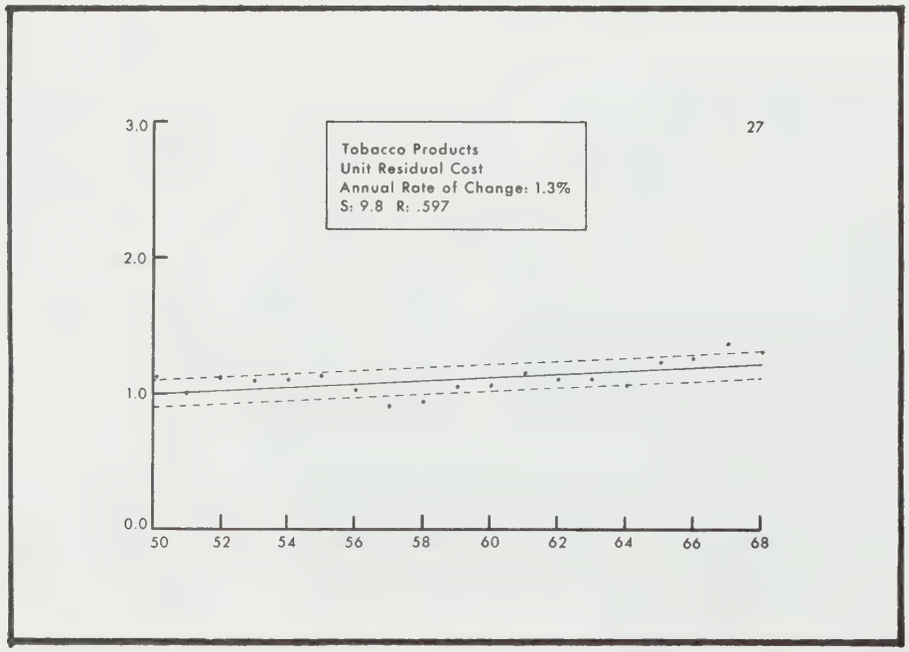
Summary Table — Principal Statistics

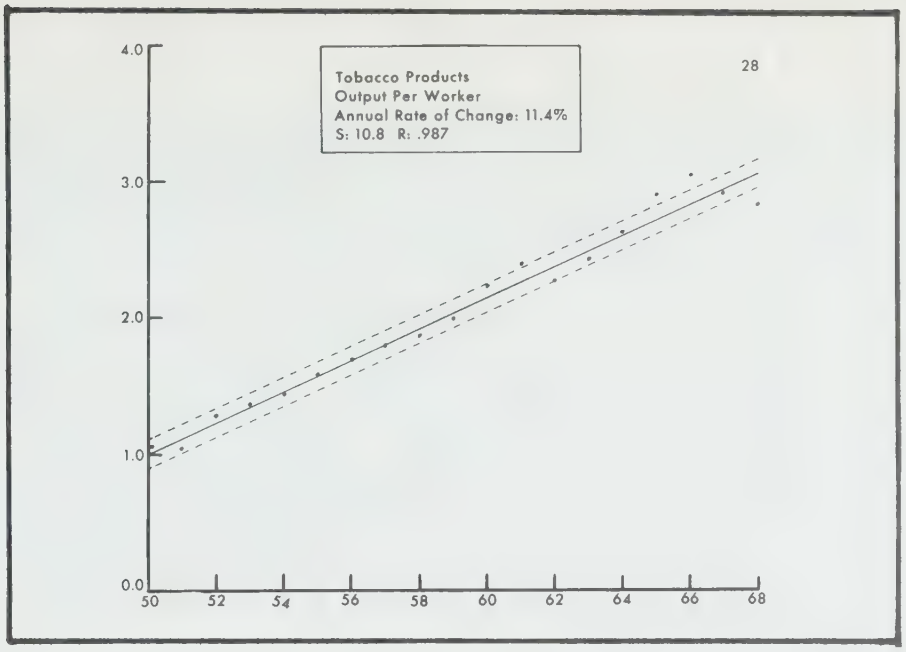
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			245.6			115.7			
Index of value added (1949 or 1961 = 100)			299.1			133.6		132.9	
Index of employment (1949 or 1961 = 100)	81.5	86.6		95.6	98.0				
Index of compensation per worker (1949 or 1961 = 100)	298.2	301.1		147.0	148.8				
Annual trend rate, compensation per worker	+8.7%	+8.8%		+8.1%	+8.2%				
Implicit, value-added price — index, 1949 or 1961 = 100			121.7			115.5		114.8	
— Annual trend rate of change			+0.6%			+4.0%		+3.8%	
— R value			.393			.895		.909	
Output per worker — index, 1949 or 1961 = 100	301.2	283.8		121.1	118.1				
— Annual trend rate of change	+12.4%	+11.4%		+5.2%	+4.6%				
— R value	.989	.987		.901	.832				
Unit labour cost — index, 1949 or 1961 = 100	99.0	106.1		121.5	125.9				
— Annual trend rate of change	−1.1%	−1.0%		+1.9%	+2.7%				
— R value	.726	.593		.516	.542				
Unit residual cost — index, 1949 or 1961 = 100	131.4	131.2		113.8	111.1		110.1		
— Annual trend rate of change	+1.3%	+1.4%		+4.8%	+4.7%		+4.3%		
— R value	.597	.622		.872	.826		.865		
Payroll as a proportion of value added 1949	29.7%	37.4%							
1961				23.0%	29.9%		30.5%		
1968	24.1%	32.6%					33.4%		
Trend rate of change in labour share	−1.5%	−1.3%		−1.7%	−1.2%		−1.1%		
— R value	.823	.772		.524	.337		.308		
Trend rate of change in residual share	+0.6%	+0.8%		+0.8%	+0.8%		+0.5%		

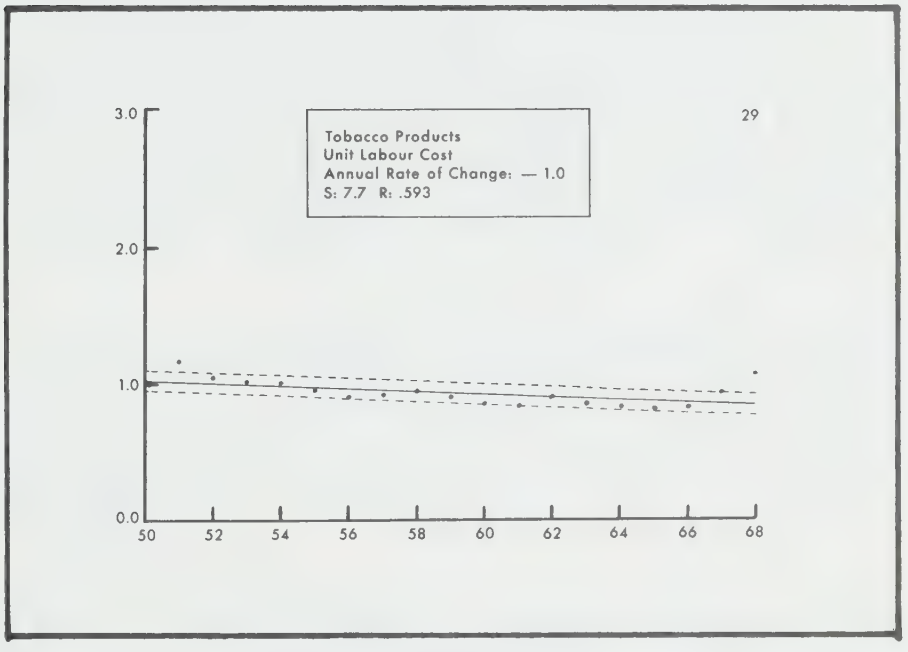
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

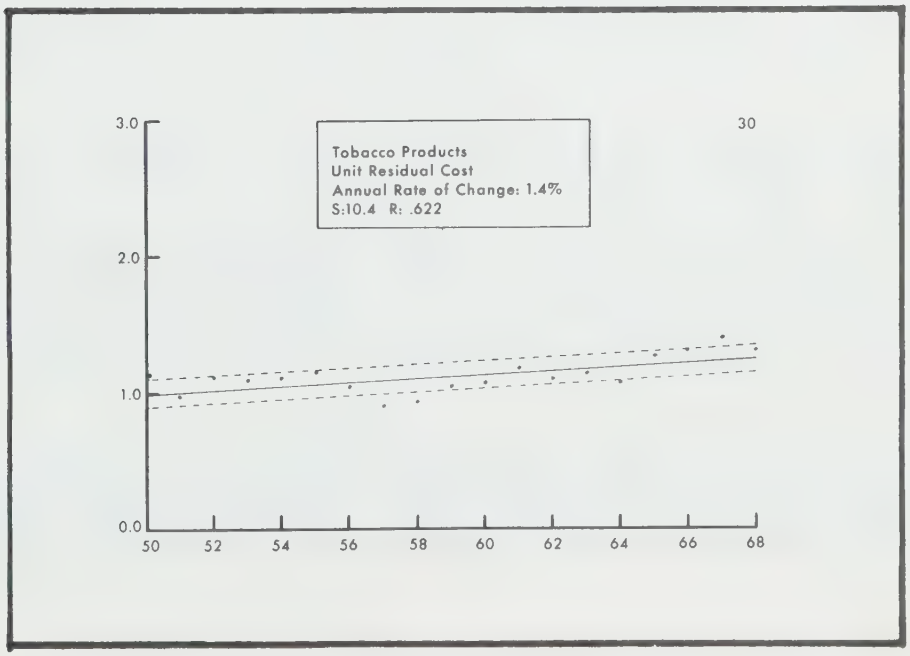

Tobacco Products
Output per Worker
Annual Rate of Change: 12.4%
S: 10.4 R: .989
25
4.0
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Tobacco Products
Unit Labour Cost
Annual Rate of Change: — 1.1%
S: 6.7 R: .726
26
4.0
3.0
2.0
0.0
50 52 54 56 58 60 62 64 66 68


Tobacco Products
Unit Residual Cost
Annual Rate of Change: 1.3%
S: 9.8 R: .597
27
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


28
Tobacco Products
Output Per Worker
Annual Rate of Change: 11.4%
S: 10.8 R: .987
4.0
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


29
Tobacco Products
Unit Labour Cost
Annual Rate of Change: — 1.0
S: 7.7 R: .593
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


30
Tobacco Products
Unit Residual Cost
Annual Rate of Change: 1.4%
S:10.4 R: .622
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

that for all manufacturing widened from 21 and 17 percent for production and total labour respectively in the full period to 29 and 30 percent in the more recent short period. Over both the full and short periods annual wages per worker increased less than average hourly earnings and occupational wage rates in the industry. Between 1949 and 1968 the increases in annual wages per worker, average hourly earnings and wage rates were 198.2, 223.2, and 223.9 percent respectively (see Table 9A); between 1961 and 1968 the increases were 47.0, 53.6 and 56.4 percent. Why these different measures of labour income should move differently is discussed in general terms in Chapter Six.

There was a reversal in the performance of the implicit (value-added) price index between the full and short periods, in relation to all manufacturing. Between 1949 and 1968 the index increased 21.7 percent, significantly less than the average of 33.0 percent (see Table 12); the annual trend rate of increase was 0.6 percent compared with 1.0 percent. During the short period, not only did the rate of increase accelerate, showing a rate of 4.0 percent, but it now greatly exceeded the average of 0.9 percent since the all-manufacturing rate changed very little. The 1961-1968 increase of 15.5 percent compares with an average increase of 6.2 percent. (The differences are not quite so great when the indexes are based on value added by total activity.) For the 1961-1968 period only three industries showed greater rates of implicit price increase (whether value added is measured according to manufacturing or total activity), while there were ten such industries for the full (1949-1968) period. The industry selling price index for tobacco products manufacturers increased 19.5 percent between 1961 and 1968, while the consumer (retail) price index for tobacco (specifically cigarettes and cigarette tobacco) increased 26.8 percent. Since they are greater than the implicit (value-added) price increases over the same period, they must be at least partly attributed to factors operating at the wholesale and retail levels.

Labour productivity increased much more than average over the full period although a good part of the advantage had disappeared over the more recent short period. Over both periods the increases were greater for production labour than for total labour. An increase of 201.2 percent in output per worker over the full period compares with 112.7 percent for all manufacturing (see Table 17); the annual trend rate of increase was 12.4 percent compared with 5.9 percent. For total labour over the full period the increase was 183.8 percent compared with 103.7 percent, or an annual rate of 11.4 percent compared with 5.8 percent. Over the short period the increase was 21.1 percent for production labour and 18.1 percent for total labour compared with 34.6 and 24.1 percent for all manufacturing. While the increases between 1961 and 1968 were less for tobacco products than for all manufacturing, the annual trend rates of increase at 5.2 and 4.6 percent continued to be higher than the rates for all manufacturing which were 3.7 and 3.9 percent. The reason for this apparent paradox (higher than average rates but lower than average increases for 1968 over 1961) is a sharp decline in output per worker in this industry between 1966 and 1968, which can be seen on the charts and in Table 17.

Over the full period and for production labour the annual rate of increase in output per worker for the tobacco products industry was exceeded in only three industries among those studied; for total labour over the full period, it was exceeded in only four industries, while over the short period the number of such industries was six with respect to both production labour and total labour. The margin by which this industry's annual rate of increase exceeded the average declined from 110 and 97 percent in the full period to 41 and 18 percent in the short period. While the upward trends were steady, for the whole period, as shown by the high R values, there were periods of especially fast increases. A glance at the charts shows that these periods are 1958-1961, when output per production worker increased 32.9 percent, and 1962-1966 when the increase was 32.3 percent, with similar increases with respect to total labour.

Unit labour cost exhibited annual rates of decline with respect to production and total labour of -1.1 and -1.0 percent respectively for the full period, compared with annual rates of increase of 0.5 and 0.7 percent for all manufacturing. The decline in productivity between 1966 and 1968, mentioned above, is reflected in an increase over the same years in unit labour cost, which is why the unit labour cost index for production labour in 1968 was almost the same, at 99.0, as it was in 1949 and for total labour was 106.1, in spite of the full-period rates of decline of one percent per annum. This is reflected in annual rates of increase of 1.9 and 2.7 percent for production and total labour over the short period and total percentage increases between 1961 and 1968 of 21.5 and 25.9 percent; but, as analysis of the charts and Table 24 will show, these increases chiefly reflect the spurt in unit labour cost between 1966 and 1968. Because of this, while unit labour cost declined in this industry over the full period, compared with an increase for all manufacturing, it increased over the short period, with respect to production labour at about the same rate as for all manufacturing, 1.9 percent compared with 2.0 percent, and, with respect to total labour, at a greater rate, 2.7 percent compared with 1.9 percent.

Unlike unit labour cost, unit residual cost increased through both the full and short periods, and while unit labour cost changed from a rate of decline to a rate of increase, unit residual cost considerably accelerated its rate of increase. But, as with unit labour cost, this acceleration was largely due to a spurt in costs in the final years, beginning for residual cost in 1964 rather than 1966 in the case of unit labour cost. This acceleration is in contrast with all manufacturing where a gradual rate of increase over the full period dropped to a condition of virtually no change over the short period.

Unit residual cost in 1968 was 31.4 and 31.2 percent greater than in 1949 with respect to production and total labour respectively, rather close to the all manufacturing increases of 38.9 and 35.1 percent (see Table 28). Similarly, the annual trend rates for 1949 to 1968 of 1.3 and 1.4 percent are the same as or close to the 1.3 and 1.2 percent for all manufacturing. Unit residual cost in 1968 was 13.8 and 11.1 percent higher in this industry than in 1961 with respect to production and total labour respectively, a significant margin over the 5.8 percent increase and 1.2 percent decrease in all manufacturing,

compared with being somewhat below the average over the full period. The short-period annual trend rates of increase are much higher, at 4.8 and 4.7 percent, than the full-period rates. A comparison with all manufacturing for the short period is not possible because its trend values are of no statistical significance, the R values being only .206 and .176, compared with .872 and .826 for tobacco products. It is worth pointing out that while eight of the industries studied had higher annual rates of increase than this industry in unit residual cost, with respect to production labour, there were only three such industries for the short period; with respect to total labour the number of such industries fell from eight to four. (Unit residual cost with respect to value added by total activity has not been included in this analysis but its behaviour has been comparable to that for total labour, 1961-1968, with respect to value added, manufacturing.)

Because of the increases in unit residual cost compared with decreases or slower rates of increase in unit labour cost, the share of labour in value added declined over both the full and short periods and at about the same rates. The production labour share dropped from 29.7 percent in 1949 to 24.1 percent in 1968, or at an annual trend rate of decline of -1.5 percent compared with an all-manufacturing rate of decline of -0.4 percent. The total labour share moved down from 37.4 to 32.6 percent, an annual rate of reduction of -1.3 percent, compared with an annual downward rate for all manufacturing of -0.2 percent. While the average trend shifted from a slight decline in the labour share over the full period to an increase over the short period, in tobacco products the labour share continued to go down, at annual rates of -1.7 and -1.2 percent over 1961-1968 for production and total labour respectively, compared with rates of increase of 1.1 and 1.0 percent for all manufacturing. The 1949 production labour share at 29.7 percent was less than the 36.8 percent for all manufacturing but it was even less in seven of the industries studied and this was also the case with the total labour share of 37.4 percent which compared with an all-manufacturing figure of 48.6 percent. The performance of the total labour share with respect to value added by total activity over 1961-1968 is similar to that with respect to value added, manufacturing except that the labour share is slightly larger.

The composition of implicit (value-added) price for the tobacco products industry is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-1.1	x	.297)	+	(1.3	x	.703)	=	0.6	0.6
Tot. lab., 1949-68[x]	(-1.0	x	.374)	+	(1.4	x	.626)	=	0.5	0.6
Prod. lab., 1961-68[x]	(1.9	x	.230)	+	(4.8	x	.770)	=	4.1	4.0
Tot. lab., 1961-68[x]	(2.7	x	.299)	+	(4.7	x	.701)	=	4.1	4.0
Tot. lab., 1961-68[y]	(2.7	x	.305)	+	(4.3	x	.695)	=	3.8	3.8

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

In every case residual cost is obviously the major component of the price change. Over the full period, the labour component kept the increase lower than it would otherwise have been, 0.5 to 0.6 percent rather than 0.9 percent which it would have been if unit labour cost had held steady rather than declined. Over the short period, with respect to value added by manufacturing, unit residual cost relative to production labour represented 90 percent of implicit price change, 80 percent relative to total labour, and 79 percent with respect to total labour and value added, total activity.

Rubber industries

This has not been an important export industry but imports have been a significant item in domestic consumption of some of the industry's output, that is, if 1965 information is representative. Exports in that year constituted only 2.1 percent of the value of production but 15.4 percent of the value of total market sales was accounted for by imports (see Table 1). The output of this industry group[12] is less homogeneous than that of the industries so far considered in this chapter and data on consumption and retail prices must be limited to certain particular products that represent only a fraction of the industry's output. The only product of this industry for which price data are specifically collected is rubber tires, which accounts for 0.3 percent of the consumer price index; rubber footwear constitutes part of the 1.6 percent of the index attributed to footwear, but it would only be a small part.

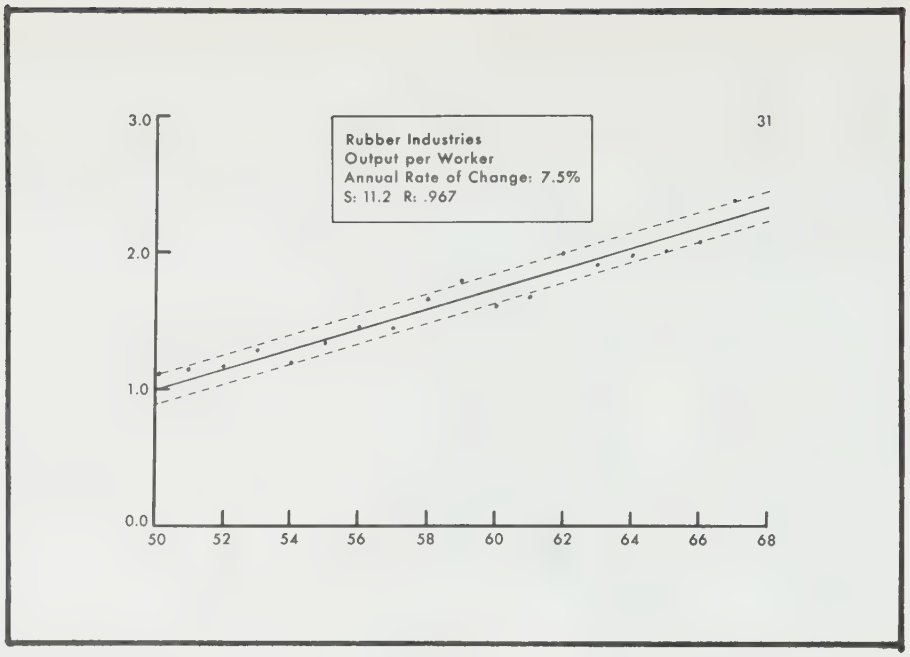
The rubber industries consist of rubber footwear manufacturers (Standard Industrial Classification code 161), tire and tube manufacturers (S.I.C. code 163), and other rubber industries (S.I.C. code 169). These industries provide a wide variety of products including rubber boots and footwear, rubber-soled canvass shoes, running shoes, tennis shoes, etc.; automobile tires and tubes, aircraft tires, tractor and truck tires, etc.; rubber belting, rubber automotive parts, rubber caps, rubber

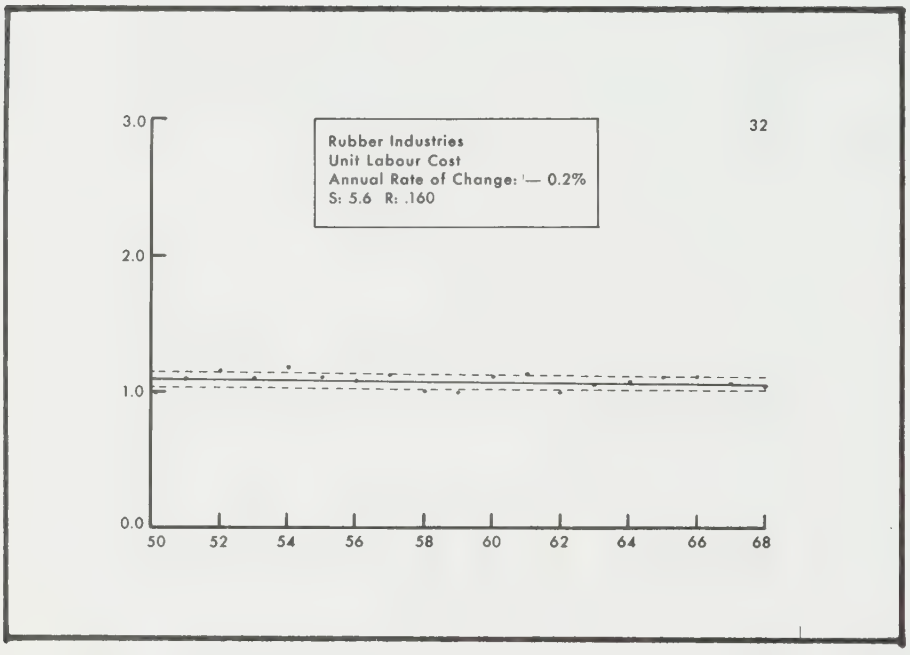
RUBBER INDUSTRIES

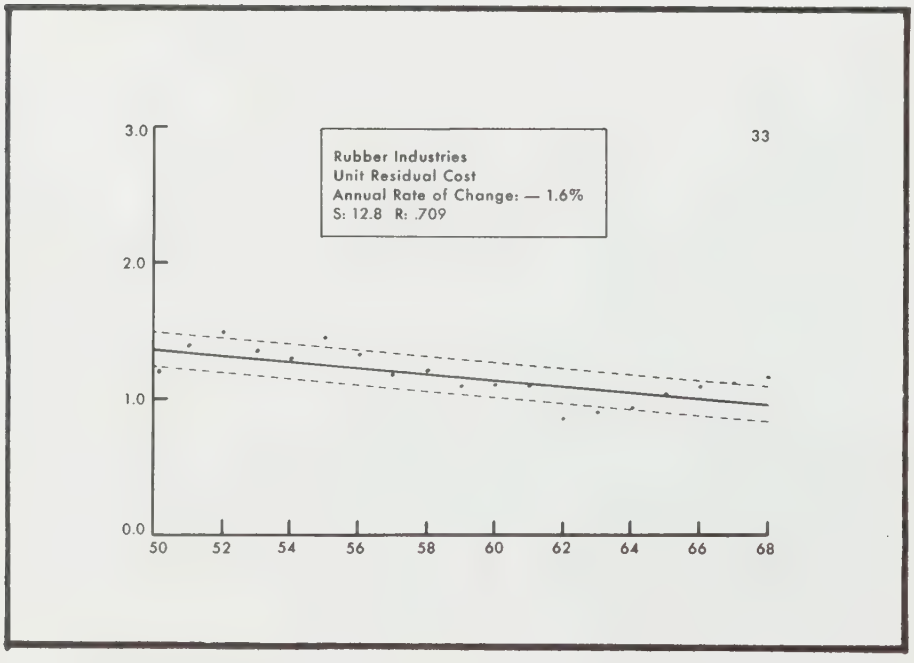
Summary Table – Principal Statistics

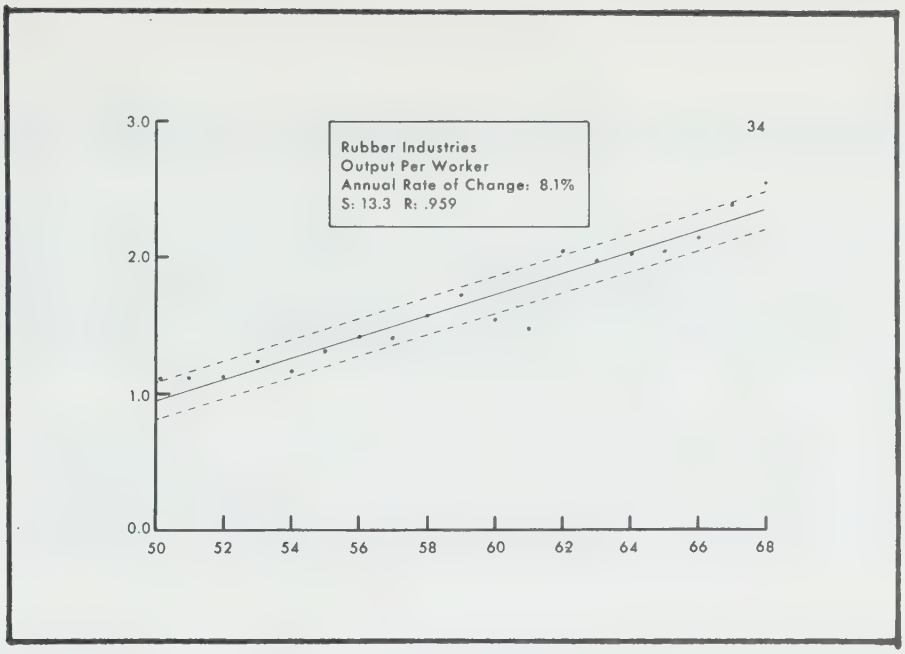
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			263.1			177.9			
Index of value added (1949 or 1961 = 100)			292.9			178.6		181.4	
Index of employment (1949 or 1961 = 100)	101.2	102.8		114.5	102.3				
Index of compensation per worker (1949 or 1961 = 100)	267.7	268.1		141.4	158.2				
Annual trend rate, compensation per worker	+7.0%	+7.1%		+5.9%	+7.7%				
Implicit, value-added price – index, 1949 or 1961 = 100			111.3			100.5		101.9	
– Annual trend rate of change			−1.2%			+4.1%		+4.1%	
– R value			.683			.969		.967	
Output per worker – index, 1949 or 1961 = 100	259.9	255.9		155.4	173.9				
– Annual trend rate of change	+7.5%	+8.1%		+5.5%	+4.7%				
– R value	.967	.959		.866	.871				
Unit labour cost – index, 1949 or 1961 = 100	103.0	104.8		91.0	90.9				
– Annual trend rate of change	−0.2%	−0.4%		+0.4%	+2.4%				
– R value	.160	.252		.258	.676				
Unit residual cost – index, 1949 or 1961 =100	115.7	117.3		105.4	109.5		111.7		
– Annual trend rate of change	−1.6%	−1.8%		+6.2%	+5.6%		+5.5%		
– R value	.709	.724		.992	.941		.945		
Payroll as a proportion of value added 1949	33.9%	47.4%							
1961				34.6%	49.2%		47.0%		
1968	31.4%	44.6%					41.9%		
Trend rate of change in labour share	+1.3%	+1.0%		−2.9%	−1.3%		−1.2%		
– R value	.687	.664		.968	.539		.531		
Trend rate of change in residual share	−0.6%	−0.7%		+1.8%	+1.2%		+1.1%		

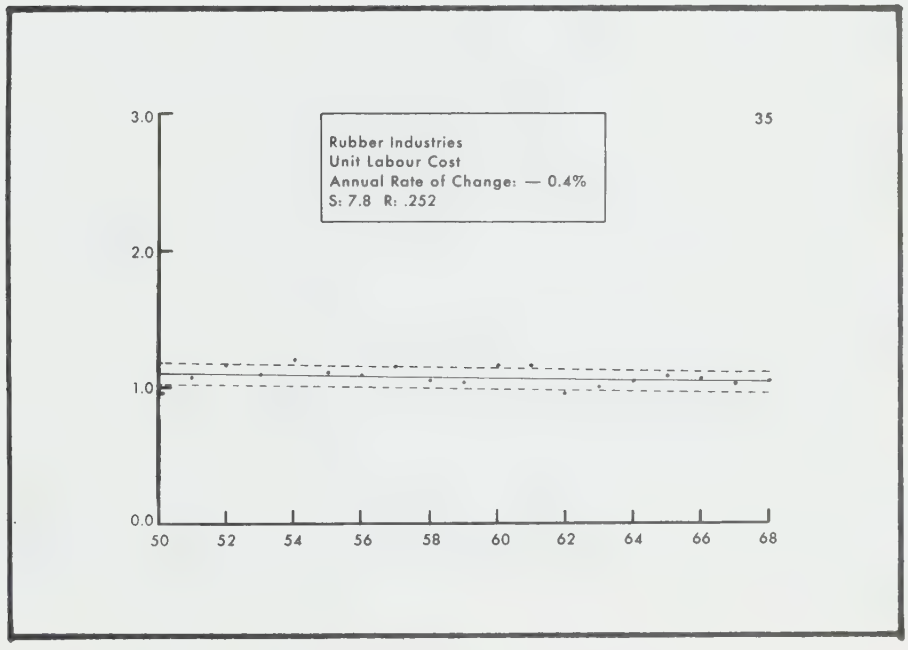
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

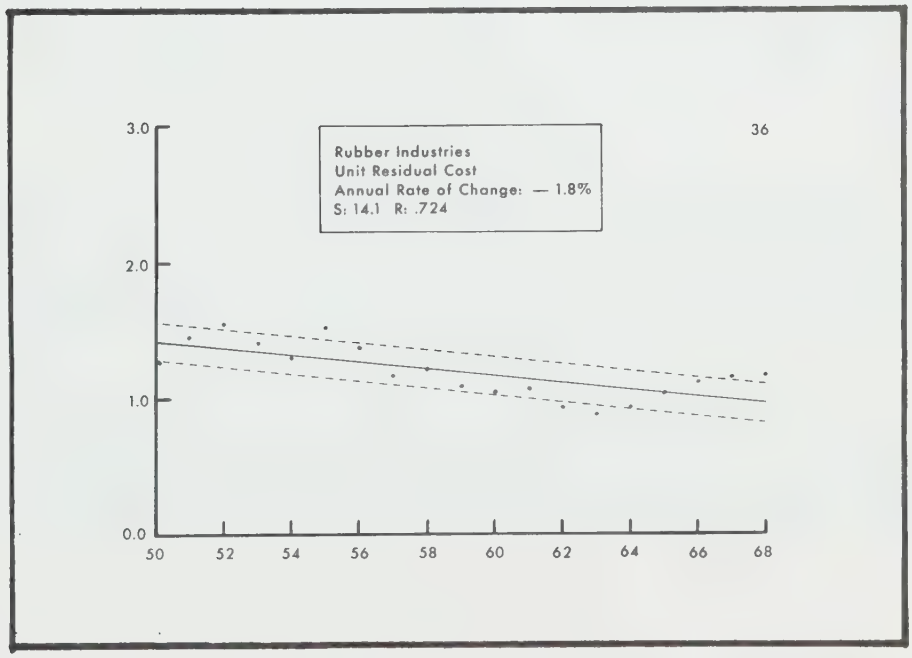

Rubber Industries
Output per Worker
Annual Rate of Change: 7.5%
S: 11.2 R: .967
31
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Rubber Industries
Unit Labour Cost
Annual Rate of Change: — 0.2%
S: 5.6 R: .160
32
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Rubber Industries
Unit Residual Cost
Annual Rate of Change: — 1.6%
S: 12.8 R: .709
33
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


34
Rubber Industries
Output Per Worker
Annual Rate of Change: 8.1%
S: 13.3 R: .959
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


35
Rubber Industries
Unit Labour Cost
Annual Rate of Change: — 0.4%
S: 7.8 R: .252
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


36
Rubber Industries
Unit Residual Cost
Annual Rate of Change: — 1.8%
S: 14.1 R: .724
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

druggists' sundries, rubber hose, rubber belting, mats, pliofilm sheets, rolls, tubing, hard rubber sheets, rubber water bottles, etc. The products assigned to these industry classes were not materially changed with the introduction of the revised S.I.C. in 1960.

Between 1949 and 1968 production increased 163.1 percent, slightly less than the average of 170.6 percent, while between 1961 and 1968, at 77.9 percent, it increased somewhat more than the average of 61.1 percent (see Table 2). A similar shift in relative increase of value added also occurred, except that the increase for this industry over the full period was more below the average than in the case of production, 192.9 percent, compared with 259.9 percent, but was just slightly above the average for the short period, 78.6 percent, compared with 71.0 percent. Over the short period value added by total activity increased 81.4 percent.

Employment of both production workers and of total labour showed little net change over the full period, production labour and total labour employment in 1968 being only 1.2 and 2.8 percent respectively greater than in 1949 (see Table 3). However, it can be seen from Table 3 that production labour employment reached its peak in 1965 when it was 21.1 percent greater than in 1949 the lowest point for total labour was 1962 when it was 5.7 percent below the 1949 level. For production labour employment increased 37 percent from the low in 1961 to the high in 1965 before levelling off in the subsequent years.

The proportion of production workers in the industry labour force in 1968 was almost the same as in 1949, 77.7 percent, compared to 76.6 percent. No real trend one way or the other, is apparent (see Table 5).

Compensation (annual wages, annual wages and salaries) per worker increased over both the full and short periods to about the same extent in the rubber industries as in all manufacturing although total labour compensation per worker increased somewhat more in the short period. The industry increases between 1949 and 1968 were 167.7 and 168.1 percent for production and total labour respectively, compared with 161.5 and 166.5 percent in all manufacturing. Between 1961 and 1968 the increases were 41.4 and 58.2 percent compared with 43.9 and 45.9 percent for all manufacturing. The annual trend rates of increase over the full period of 7.0 and 7.1 percent for production and total labour respectively are close to the rates of 7.2 and 7.5 percent for all manufacturing. Over the more recent period the rate for production labour of 5.9 percent fell a little more behind the rate for all manufacturing, which was 6.3 percent, while conversely the rate for total labour, at 7.7 percent, pulled ahead of the all-manufacturing rate which was, as with production labour, 6.3 percent. The first three of these annual rates of increase held close to the mid-point among the industries studied, but the last was one of the highest; over the full period there were seven industries showing smaller rates of increase in compensation per worker, be it production or total labour, and over the short period, with respect to production labour, there were ten industries having smaller rates of increase, while, with respect to total labour, there were only two industries with higher rates (see Table 11).

Between 1949 and 1968 annual wages (i.e. compensation) per production worker increased 167.7 percent while average hourly earnings rose 147.6 percent and occupational wage rates 134.4 percent (see Table 9A). Between 1961 and 1968, there was much greater uniformity in the increases in annual wages per worker, average hourly earnings and wage rates, being 41.5, 38.3, and 40.4 percent. The greater increase in annual wages over the full period than in hourly earnings is exceptional (see Chapter Six); it is more often the case that hourly earnings show the greater increase. On the basis of information at hand, an explanation cannot be offered.

Implicit (value-added) price was 11.3 percent higher in 1968 than in 1949, but there was an annual trend rate of decline of -1.2 percent. The reason for this can be immediately discerned from an examination of Table 12; from 1949 to 1952 there was a rise of 36.7 percent, followed by an almost steady drop (with breaks in 1955, 1960 and 1961), so that the trend, after the first three years, was for implicit price to fall, until 1963 when a gradual rise took effect. This also explains why, even though the index in 1968 was virtually the same as in 1961, a trend rate of increase of 4.1 percent is indicated for the short period which in fact reflects what happened between 1962 and 1968 after, it should be emphasized, a substantial drop between 1961 and 1962.

The full-period annual trend rate of decrease of -1.2 percent compares with an all manufacturing rate of increase of 1.0 percent. Only three other industries registered rates of decrease and while one was the same as that for the rubber industries, none were lower. The situation is reversed in the short period with an annual rate of increase in this industry of 4.1 percent, which has just been explained above, and is considerably in excess of the rate of increase of 0.9 percent for all manufacturing. Indeed, while no industry shows a greater rate of decrease in implicit (value-added) price over the full period, only two industries show greater rates of increase over the short period.

The closeness of 1968 implicit price to that for 1961 also applies to the industry selling price index which in fact was 2.1 percent less in 1968 than it was in 1961. The only available data on retail price change for products of this industry are the consumer price index for tires, which indicates a 16.2 percent increase between 1961 and 1968, and for rubber and plastic footwear, which shows an increase of 19.9 percent. Since these are two of the most important products of the industry and, even allowing for the fact that plastic footwear is priced along with rubber footwear, it seems clear that retail prices for at least

these important products of the industry have risen over a period when wholesale and implicit (value-added) prices have remained steady. Therefore, the higher retail prices must be attributed to effects operating at the retail and not at the wholesale or manufacturing levels.

Labour productivity increased at a greater than average rate over both the full and short periods with the margin over the average substantially greater in the short than in the full period for production labour and the opposite being the case for total labour. Between 1949 and 1968 output per production worker increased 159.9 percent and 155.9 percent for total labour, compared with increases of 112.7 and 103.7 percent for all manufacturing (see Table 17). The annual trend rates of increase were 7.5 and 8.1 percent for production and for total labour respectively, compared with all-manufacturing rates of 5.9 and 5.8 percent, the rates for this industry being 27 and 40 percent above the all-manufacturing rates.

Between 1961 and 1968 output per worker increased 55.4 and 73.9 percent for production and for total labour respectively, compared with average increases of 34.6 and 24.1 percent. The annual trend rates of increase were less than for the full period, being 5.5 and 4.7 percent for production and for total labour, with the production labour rate widening its margin over that for all manufacturing from 27 to 49 percent, with the all-manufacturing rate being 3.7 percent; however, the margin for the rate related to total labour was reduced from 40 to 21 percent, the all-manufacturing rate being 3.9 percent.

While the rates of increase in output per worker were higher than average, they were not exceptionally so. Over the full period 11 industries had higher rates with respect to production labour and eight with respect to total labour. Over the short period fewer industries had rates exceeding this industry's, four with respect to production labour and five with respect to total labour. The high R values indicate a strong trend over both the full and short periods but the charts indicate that there were some sharp accelerations, as for example, in the case of production labour, when output per worker increased 19.2 percent between 1961 and 1962, 24.2 percent between 1957 and 1959, and 25.1 percent between 1966 and 1968. Similar periods for total labour can be discerned from the chart and scrutiny of Table 17.

With labour productivity increasing faster than compensation per worker over the full period, unit labour cost fell, but over the short period labour productivity was not increasing as rapidly as compensation per worker, so that unit labour cost increased. In most industries unit labour cost increased more through 1961-1968 than 1949-1968 but in this industry and a few others the trend was more pronounced inasmuch as there was a reversal from a decline in unit labour cost over the full period to an increase over the short period.

Unit labour cost in 1968 was 3.0 percent greater than in 1949 for production labour and 4.8 percent greater for total labour, compared with increases of 23.0 and 30.8 percent for all manufacturing (see Table 24). Over the full period there was no statistically significant trend upwards or downwards; the trend rates of decrease of -0.2 percent and -0.4 percent had R values of only .160 and .252. Analysis of the charts and Table 24 shows why. Unit labour cost increased 15.3 percent and 16.4 percent for production and for total labour between 1949 and 1952, followed by a downward trend from 1954 to 1959, a jump upwards in the next two years, a sudden drop in 1961 with a slight upward movement in the remaining years. Over the short period, while the trend rate with respect to production labour changed from -0.2 percent to a rate of increase of 0.4 percent, like the full-period rate, it was statistically insignificant ($R = .258$); the rate for total labour, with $R = .676$, was significant at the 99 percent level, showing an annual rate of increase of 2.4 percent. It can be said, therefore, that unit labour cost moved from a position of no net change in the 1950's to one of an upward trend in the 1960's, chiefly when nonproduction labour is taken into account along with production labour.

Over the full period, unit residual cost exhibited a definite downward trend until 1962, strong enough to produce negative annual trend rates for the full period, followed by a definite upward trend from 1962 to 1968. This is readily apparent from the charts. This is why unit residual cost in 1968 was 15.7 percent greater than in 1949 with respect to production labour and 17.3 percent greater with respect to total labour even though the annual trend rates of change were -1.6 and -1.8 percent.

Over the full period 1968/1949 increases were less than half the average increases of 38.9 and 35.1 percent for production and for total labour. No other industry covered registered annual rates of decrease as large as those mentioned above for the full period. The rates of -1.6 and -1.8 compare with rates of increase for all manufacturing of 1.3 and 1.2 percent. Because of the sharp change of direction in unit residual cost, beginning in 1962 with respect to production labour and in 1963 with respect to total labour, the annual trend rates for the more recent, 1961-1968 period were not only rates of increase (compared with rates of decrease over the full period) but, at 6.2 and 5.6 percent with respect to production and total labour respectively, they were higher than for all but one other industry. Unit residual cost with respect to total labour but related to value added by total activity, showed an annual trend rate, at 5.5 percent, just about the same as the rate based on value added by manufacturing only.

The apparent contradiction between a decline in the production labour share of value added, manufacturing from 33.9 percent in 1949 to 31.4 percent in 1968 and an annual trend rate of increase, not decrease, of 1.3 percent over 1949-1968 is easily explained. Examination of the data in column A for the rubber industries in Table 34 indicates a sharp decline from 33.9 to 29.6 percent in the labour share in one year, from 1949 to 1950, a reduction of almost 13 percent. This was followed

by smaller declines over the next two years and a rather steady increase from 1952 to 1963 and a decline thereafter through to 1968. The 32 percent rise in the labour share over the 11 years from 1952 to 1963 accounts for the full-period annual trend rate of increase of 1.3 percent, and the 17 percent decrease over the six years from 1963 to 1968 accounts for the short-period annual trend rate of decrease of -2.9 percent. A similar explanation applies to the total labour share as well.

The reversal from a full-period annual rate of increase in the labour share to a short-period rate of decrease is the opposite of what applies to all manufacturing. On the other hand, the labour share in this industry is close to that for all manufacturing; the 1968 production labour share was 31.4 percent in this industry and 34.0 percent in all manufacturing with the total labour share, 44.6 percent, and 47.8 percent in all manufacturing. Related to value added by total activity, the total labour share was little smaller, at 41.9 percent in 1968.

Because of the rather substantial changes in factor shares from year to year, a computation of the rate of change of residual share using current rather than base weights produces rather different results. This is the first industry so far discussed in this chapter where such is the case. The base-weighted and current-weighted computations of annual trend rates of change in residual share may be obtained, upon request, from the Canada Department of Labour, Economics and Research Branch.

The composition of implicit (value-added) price for the rubber industries is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-0.2	x	.339)	+	(-1.6	x	.661)	=	-1.1	-1.2
Tot. lab., 1949-68[x]	(-0.4	x	.474)	+	(-1.8	x	.526)	=	-1.1	-1.2
Prod. lab., 1961-68[x]	(0.4	x	.346)	+	(6.2	x	.654)	=	4.2	4.1
Tot. lab., 1961-68[x]	(2.4	x	.492)	+	(5.6	x	.508)	=	4.0	4.1
Tot. lab., 1961-68[y]	(2.4	x	.470)	+	(5.5	x	.530)	=	4.0	4.1

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

For the full period both cost components were declining, so implicit price had to be moving down. Since unit production labour cost was not declining as fast, implicit price would have decreased about 0.5 percent more per year if unit labour cost had been declining at the same rate; the difference would be 0.6 percent in the case of total labour. On the other hand, over the short period, when implicit price and both unit cost components were rising, because unit labour cost was rising less rapidly, implicit price would have shown greater increases if unit labour cost had been changing at the same rate; by 2.0 percent more per annum in the case of production labour, and by 1.6 and 1.5 percent in the case of total labour, related to value added by manufacturing and by total activity.

Cotton yarn and cloth mills

This is not an exporting industry in this country, the value of exports in 1965 (on the basis of measures for that year compiled for this study) constituting only 1.3 percent of the value of production (see Table 1), but imports are an important source of supply to the domestic consumer constituting in 1965, 25.3 percent of the value of total market sales. Much of the output of this industry goes to other industries for the manufacture of clothing and other products, so that the full importance of the industry to the domestic market cannot be measured in this study. It can be seen that 0.7 percent of the consumer price index is related to textiles used in household operation (cotton sheets, curtains, towels, but also including some materials such as wool blankets and plastic that are not products of the industry here under examination); furthermore, textiles (cotton and other kinds) are essential to clothing that constitutes 11.3 percent of the consumer price index.

Cotton yarn and cloth mills (Standard Industrial Classification code 183) are primarily engaged in spinning, twisting, winding or spooling cotton yarn and in weaving fabrics such as sheetings, prints, towellings, drapery and upholstery fabrics, etc. Changes made in the commodities and activities attributed to the industry did not change significantly with the introduction of the new S.I.C. in 1960.

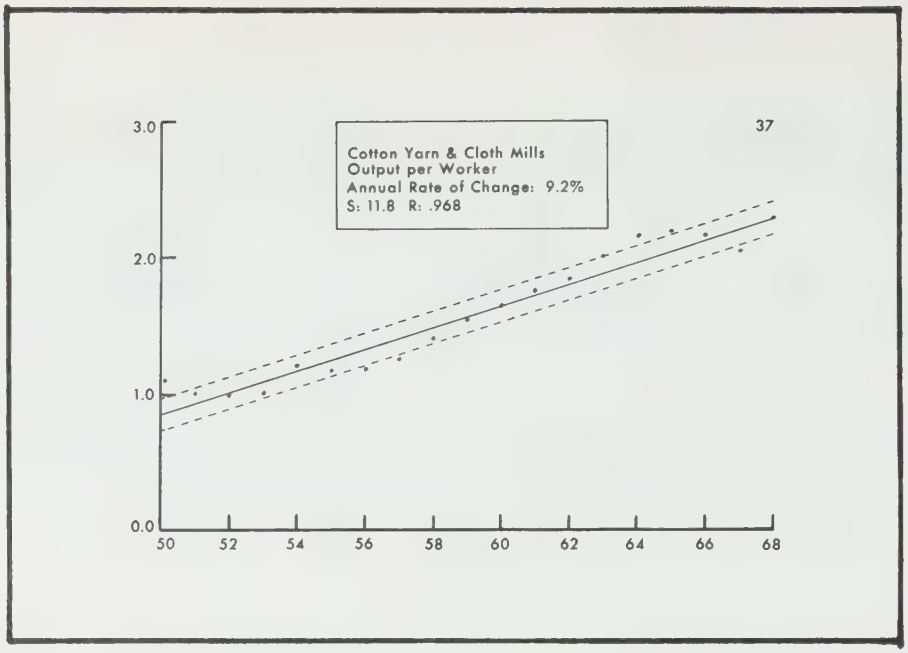
This industry registered the smallest increases of all the industries studied, with one exception, in both production and in value added over both the full and the short periods. One industry showed a smaller increase in production over the 1949-1968 period and one showed almost as small an increase in value added by manufacturing over 1961-1968. (Value added by total activity is not considered here.) The full-period increase of 18.7 percent in production compares with 170.6

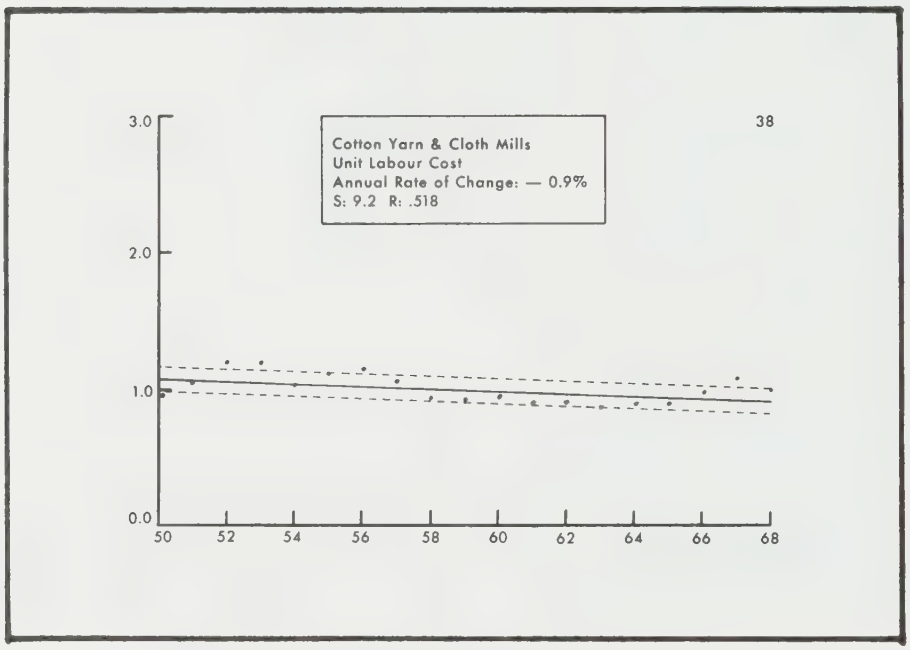
COTTON YARN AND CLOTH MILLS

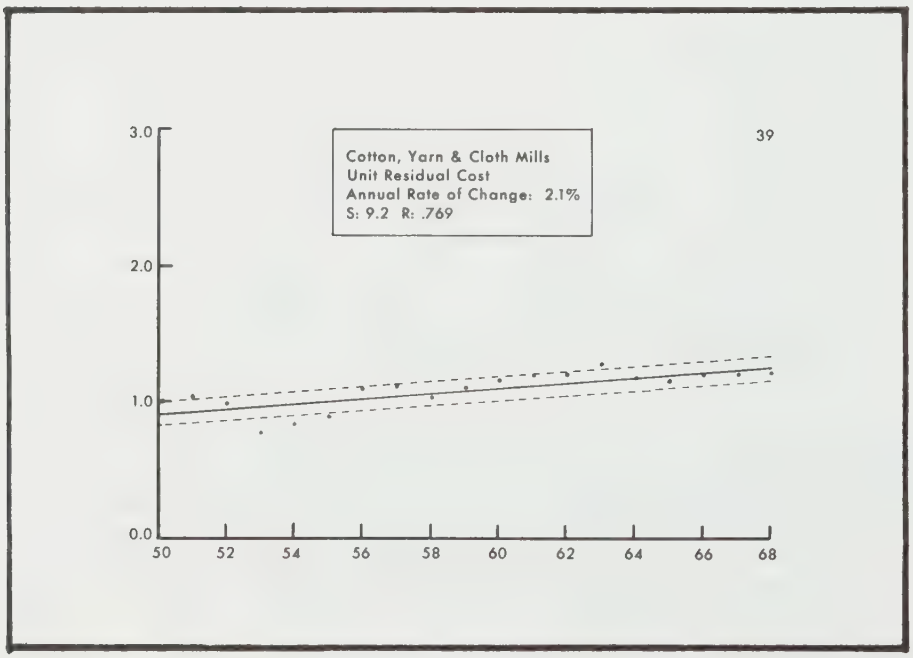
Summary Table – Principal Statistics

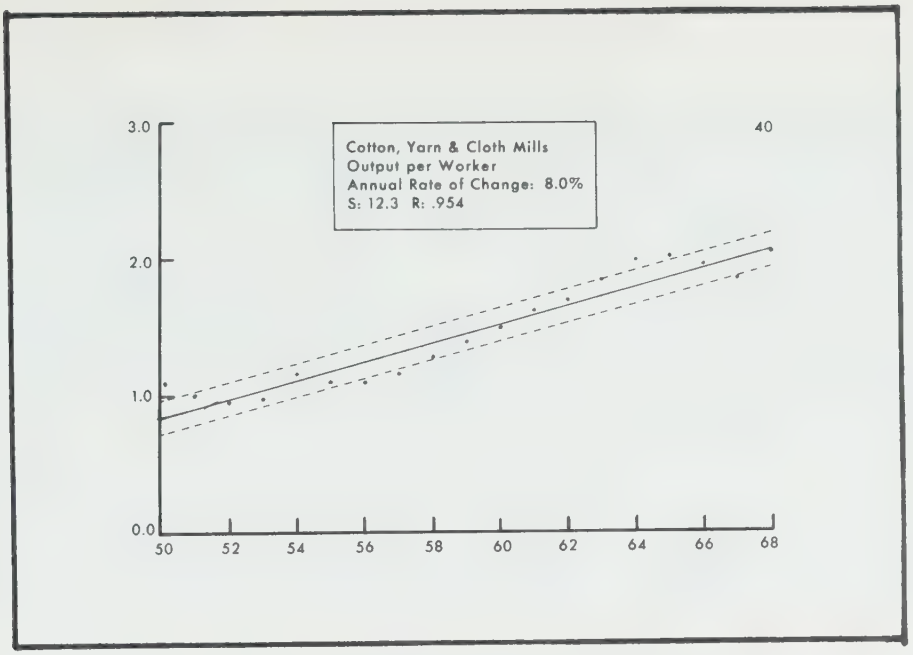
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			118.7			106.6			
Index of value added (1949 or 1961 = 100)			130.3			113.0		112.1	
Index of employment (1949 or 1961 = 100)	52.0	58.1		82.0	84.1				
Index of compensation per worker (1949 or 1961 = 100)	224.4	238.7		142.9	145.8				
Annual trend rate, compensation per worker	+7.0%	+7.3%		+6.2%	+7.0%				
Implicit, value-added price – index, 1949 or 1961 = 100			109.7			106.0		105.0	
– Annual trend rate of change			+0.4%			+1.3%		+1.4%	
– R value			.445			.681		.698	
Output per worker – index, 1949 or 1961 = 100	228.1	204.4		130.1	127.0				
– Annual trend rate of change	+9.2%	+8.0%		+2.5%	+2.2%				
– R value	.968	.954		.736	.658				
Unit labour cost – index, 1949 or 1961 = 100	98.4	116.8		109.9	114.3				
– Annual trend rate of change	−0.9%	−0.3%		+3.2%	+4.2%				
– R value	.518	.183		.782	.818				
Unit residual cost – index, 1949 or 1961 = 100	122.2	99.7		102.8	93.5		91.6		
– Annual trend rate of change	+2.1%	+1.9%		−0.6%	−2.3%		−2.1%		
– R value	.769	.548		.342	.823		.800		
Payroll as a proportion of value added 1949	52.0%	59.4%							
1961				44.9%	58.3%		57.9%		
1968	46.6%	63.2%					63.3%		
Trend rate of change in labour share	−1.2%	−0.7%		+1.7%	+2.6%		+2.6%		
– R value	.713	.450		.763	.854		.849		
Trend rate of change in residual share	+1.5%	+1.4%		−1.8%	−3.4%		−3.2%		

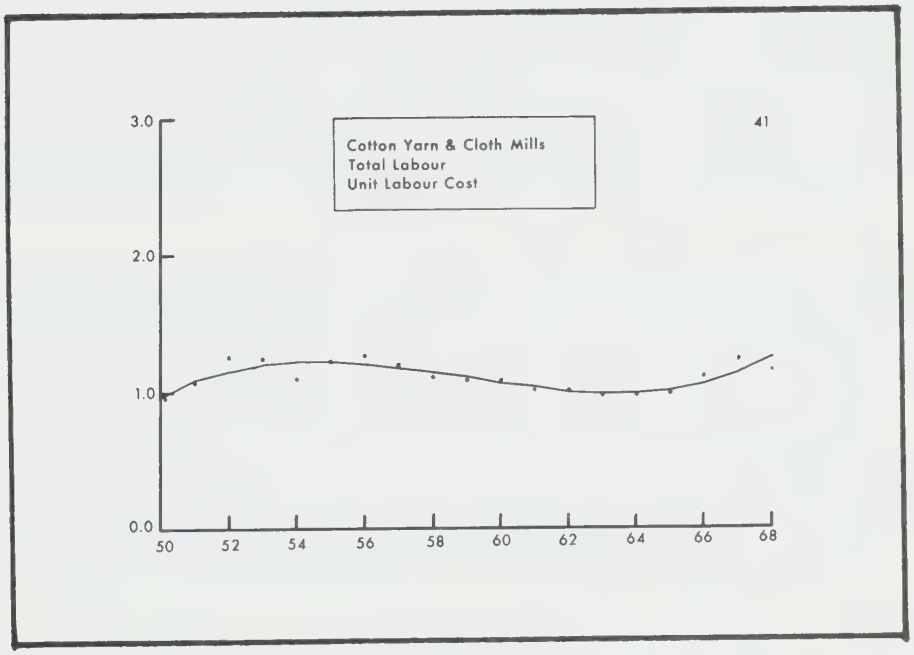
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

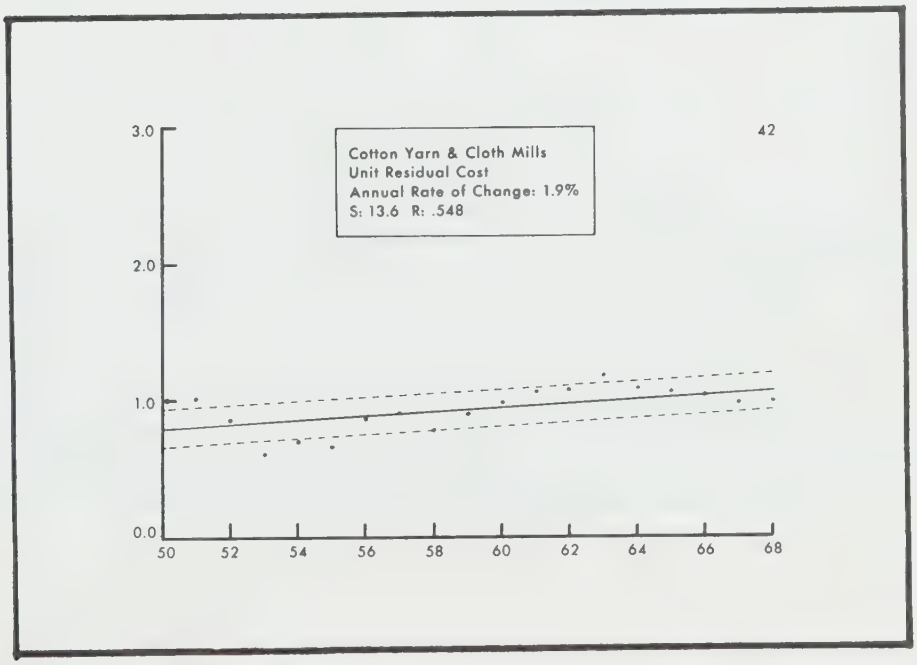

37
Cotton Yarn & Cloth Mills
Output per Worker
Annual Rate of Change: 9.2%
S: 11.8 R: .968
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


38
Cotton Yarn & Cloth Mills
Unit Labour Cost
Annual Rate of Change: — 0.9%
S: 9.2 R: .518
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


39
Cotton, Yarn & Cloth Mills
Unit Residual Cost
Annual Rate of Change: 2.1%
S: 9.2 R: .769
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


40
Cotton, Yarn & Cloth Mills
Output per Worker
Annual Rate of Change: 8.0%
S: 12.3 R: .954
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


41
Cotton Yarn & Cloth Mills
Total Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


42
Cotton Yarn & Cloth Mills
Unit Residual Cost
Annual Rate of Change: 1.9%
S: 13.6 R: .548
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

percent for all manufacturing (see Table 2). Over the same period value added by manufacturing increased by 30.3 percent, compared with 259.9 percent for all manufacturing. Over the short period production increased 6.6 percent compared with 61.1 percent for all manufacturing and value added by manufacturing increased 13.0 percent compared with 71.0 percent. It is true that both production and value added had reached higher levels in 1964 and 1965 before levelling off (see Table 2), but even in these years the increases were greatly below average.

The very small increases in output, combined with above average increases in labour productivity over the full period (discussed below) were responsible for a large reduction in both production worker and total employment between 1949 and 1968. Reductions in labour productivity to below average rates of increase by 1961-1968 meant that employment did not fall nearly as much over the short period as it did over the full period. There were no other industries among those studied that showed such large reductions of both production worker and total employment.

In 1968 production labour employment was only 52.0 percent of its 1949 level, compared with an increase between the same years of 27.2 percent for all manufacturing (see Table 3). Total labour employment, at 58.1 percent, decreased only slightly less, compared with an all-manufacturing increase of 32.8 percent. However, the reduction in employment was not as great between 1961 and 1968; production worker employment in 1968 was 82.0 percent of its 1961 level, while all-manufacturing employment increased 19.7 percent between those two years; total labour employment was 84.1 percent of the 1961 level, compared with a 29.8 percent increase for all manufacturing.

In 1949 only one industry among those studied had a larger proportion of production labour to total employment. In this industry it was 91.6 percent (see Table 5). By 1968 there were four such industries and the proportion in this industry had dropped to 82.1 percent. The 1949 proportion was 13 percent greater than the 81.1 percent for all manufacturing and by 1968 the margin had dropped to six percent. However, in spite of the large reduction in the production worker proportion 10.4 percent, compared with 4.2 percent for all manufacturing there were seven other industries where the percentage reduction was greater and there was one industry where it was the same. The annual trend rate of decline of -0.5 percent was significantly greater than the negative trend rate of -0.1 percent for all manufacturing, but there were seven industries where the rate of reduction was even more. As indicated above, by 1968 the production labour proportion was still greater than average but by a smaller margin than in 1949.

Compensation (annual wages or annual wages and salaries) per worker increased slightly less than average over the full period, and over the short period about the same as average for production labour and slightly more than average for total labour. In 1968 compensation per production worker was 124.4 percent greater than in 1949, compared with 161.5 percent in all manufacturing; the annual trend rate of increase was 7.0 percent compared with 7.2 percent. In 1968 compensation per worker for total labour was 138.7 percent higher, compared with 166.5 percent in all manufacturing, the annual trend rate of increase being 7.3 percent compared with 7.5 percent. Between 1961 and 1968 compensation per production worker increased 42.9 percent compared with the average of 43.9 percent, and at an annual trend rate of increase of 6.2 percent, compared with 6.3 percent, while for total labour the increase between the two years was 45.8 percent, in effect the same as the 45.9 percent for all manufacturing, and the annual trend rate of increase was 7.0 percent, somewhat more than the 6.3 percent for all manufacturing. (Obviously, a trend rate is based on all year-to-year changes and not just the difference between the base and terminal years, which is why here and in many other situations the trend rate seems inconsistent with what the base-terminal year difference would suggest.)

While annual wages per production worker increased 124.4 percent over the full period, average hourly earnings increased 138.8 percent and occupational wage rates 134.0 percent (see Table 9A). Between 1961 and 1968 the respective increases were 42.9, 45.0 and 42.0 percent. The reasons for differences in these increases are discussed in general terms in Chapter Six.

Implicit (value-added) price increased less than average over the full period and somewhat more than average over the short period. In 1968 it was only 9.7 percent greater than in 1949, compared with an increase for all manufacturing of 33.0 percent (see Table 12); the annual trend rate of increase was 0.4 percent, compared with 1.0 percent for all manufacturing. Between 1961 and 1968 implicit price increased 6.0 percent, in line with 6.2 percent for all manufacturing, but the annual trend rate of increase was 1.3 percent, compared with 0.9 percent for all manufacturing. With respect to value added by total activity, however, the short-period annual rate of increase of 1.4 percent was less than the average rate of increase of 1.7 percent. Between 1961 and 1968 the industry selling price index, representing in large measure wholesale price changes, increased 8.3 percent, more than the implicit price (value-added, manufacturing) increase of 6.0 percent and the increase of 5.0 percent with respect to value added by total activity. The consumer price index for cotton textiles indicates an increase of 17.6 percent in retail price over this period, which indicates a much greater price increase at the retail than at the wholesale or manufacturing levels.

Output per worker, for both production and total labour, increased at significantly greater than average annual rates over the full period, but because of a downward reversal beginning in 1964, the 1968 indexes over 1949 are less than the trend rates would suggest; for the same reason the 1961-1968 trend rates are below average.

Output per production worker increased 128.1 percent between 1949 and 1968 and for total labour the increase was 104.4 percent (see Table 17); the increases compare with 112.7 and 103.7 percent for all manufacturing. Over this period, the annual trend rates of increase for production and for total labour were 9.2 and 8.0 percent respectively, compared with 5.9 and 5.8 percent for all manufacturing. The 1961-1968 increases were 30.1 and 27.0 percent for production and total labour respectively, close to the increases of 34.6 and 24.1 percent in all manufacturing. But the annual trend rates of increase of 2.5 and 2.2 percent are significantly less than the rates of 3.7 and 3.9 percent for all manufacturing. They are also much less than the full-period rates of 9.2 and 8.0 percent for the industry. Smaller annual improvements in labour productivity in the 1960's compared with the 1950's is a rather general pattern for most of the industries studied, but the slowing down was more pronounced in this industry. An inspection of the charts shows that for both production and total labour the big increase in output per worker took place during the years from 1956 to 1964; over this period output per production worker increased 83.2 percent and for total labour it increased 82.0 percent, the increases before and after this period being much less. While the full-period rates of increase were above average and the short-period rates below average, they were not unusually above or below, several industries in each instance having lower and other industries higher rates than those in cotton yarn and cloth mills.

Increases in compensation per worker fairly close to the average, coupled with better than average increases in output per worker over the full period, meant some reduction in unit labour cost; but a considerable reduction in the growth rate of labour productivity over the short period, along with worker compensation increasing at about the same rate as before, meant rising unit labour cost during these years.

Unit labour cost for production labour in 1968 was 1.6 percent below its 1949 level, compared with an all-manufacturing increase of 23.0 percent (see Table 24). There was an annual trend rate of decline of -0.9 percent for 1949-1968 chiefly because of a downward trend between 1956 and 1964, the result of the increase over the same years in output per worker; this compares with an annual rate of increase in all manufacturing of 0.5 percent. With respect to total labour, unit labour cost in 1968 was 16.8 percent higher than in 1949. There was a sharp rise between 1964 and 1968 after several years of gradual decline. The trend rate of decline of -0.3 percent, with an R value of only .183, is without statistical significance, because it happens that a nonlinear trend is more appropriate in this instance, raising the R from .183 to the significant value of .855 (see Appendix C). Of course, with a nonlinear trend one cannot speak of an average annual rate of change which implies a straight-line trend.

Over the short period unit labour cost moved up because of the increase between 1964 and 1968. The 1961-1968 increases of 9.9 and 14.8 percent for production and for total labour respectively are not very different from the increases of 6.9 and 17.6 percent in all manufacturing, but the annual trend rates of increase of 3.2 and 4.2 percent for production and total labour are significantly higher than the all-manufacturing rates of 2.0 and 1.9 percent. It should be added that the short-period trends are statistically significant, with R values of .782 and .818.

Unit residual cost increased more than average over the full period and decreased more than average over the short period. As with output per worker and unit labour cost, there was a sharp change in direction around 1964. Because of this reversal, the index for unit residual cost, with respect to production labour, was only 22.2 percent higher in 1968 than in 1949 (see Table 28) in spite of an annual trend rate of increase of 2.1 percent over the full period. The 1968 index with respect to total labour was actually 0.3 percent less than in 1949 in spite of an annual trend rate of increase of 1.9 percent. These rates of 2.1 and 1.9 percent are higher than the all-manufacturing rates of 1.3 and 1.2 percent.

With respect to production labour, unit residual cost increased 24.3 percent between 1958 and 1963, dropped 8.0 percent in the following year and after a moderate increase, levelled off over the last three years. With respect to total labour, unit residual cost increased 50.6 percent between 1958 and 1963 and declined at a moderate but steady pace thereafter. It will be recalled that unit residual cost relative to production labour contains nonproduction labour as well as nonlabour cost elements, whereas unit residual cost relative to total labour contains only nonlabour cost. The fact that the measure relative to production labour showed a moderate rise over the 1964-1968 period while the measure relative to total labour moved downward indicates that nonlabour costs were falling while labour costs were rising.

It can thus be understood why the annual trend rates shifted from rates of increase of 2.1 and 1.9 percent over the full period to rates of decrease of -0.6 and -2.3 percent over the short period, and why a greater rate of decline in the latter than the former. It also explains why unit residual cost in 1968, compared with 1961, was 1.7 percent higher with respect to production labour and 7.1 percent less with respect to total labour. The short-period downtrend in this industry compares with a situation of no net change in all manufacturing. The short-term rate relative to total labour and value added, total activity was -2.1 percent, compared with a rate of increase of 1.6 percent in all manufacturing.

Concerning the 2.1 percent full-period annual trend rate for unit residual cost (production labour), 12 of the industries studied had lower rates of increase or rates of decrease; there were 11 such industries with respect to the rate of 1.9 percent relative to total labour. There were six industries in which the short-period trend in unit residual cost (production labour) showed a greater decline than the -0.6 percent in this industry, and there were four such industries with respect to the rate of -2.3 percent relative to total labour. (The measure related to total activity is not included here.)

The production labour share of value added moved down from 52.0 percent in 1949 to 44.9 percent in 1961 and then moved up somewhat to 46.6 percent. The result is a full-period annual trend rate of decline of -1.2 percent and a short-period upward trend rate of 1.7 percent. The full-period downtrend and the short-period uptrend are in line with that for all manufacturing but the rates for this industry are greater in each case.

The total labour share moved down slightly from 59.4 percent in 1949 to 58.3 percent in 1961 and then moved up to 63.2 percent by 1968. In spite of the higher value for 1968 than 1949, there was a full-period annual trend rate of decrease rather than increase. This is because of a substantial increase in the total labour share to 75.1 percent in 1953 from 59.4 percent in 1949, followed by a rather steady drop to a low of 54.7 percent by 1963, after which it started to increase once more (see Table 34). These fluctuations in the labour share and, it follows, in the residual share, are greater than in most of the industries studied and are, of course, a result of the fluctuations in unit labour cost and unit residual cost each in relation to the other. (This discussion is limited to those measures of factor shares related to value added by manufacturing.)

At 52.0 percent in 1949 and 46.6 percent in 1968, the production labour shares were significantly higher than the all-manufacturing shares of 36.8 and 34.0 percent for the same years. Similarly, the total labour shares of 59.4 and 63.2 percent were higher than 48.6 and 47.8 percent for all manufacturing. Only one industry had a labour share as high as that for production labour, and it was virtually the same, and with respect to total labour, there were only two such industries. Cotton yarn and cloth mills continued to be relatively labour intensive.

Because of the many changes in the factor shares over the whole time period, it is understandable that current-weighted computations of annual rates of change in the residual share are somewhat different from those that are base-weighted, which, as explained in Chapter Nine, are used in this study. The interested reader may obtain comparative data upon request from the Canada Department of Labour, Economics and Research Branch.

The composition of implicit (value-added) price for cotton yarn and cloth mills is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-0.9	x	.520)	+	(2.1	x	.480)	=	0.5	0.4
Tot. lab., 1949-68[x]	(-0.3	x	.594)	+	(1.9	x	.406)	=	0.6	0.4
Prod. lab., 1961-68[x]	(3.2	x	.449)	+	(-0.6	x	.551)	=	1.1	1.3
Tot. lab., 1961-68[x]	(4.2	x	.583)	+	(-2.3	x	.417)	=	1.5	1.3
Tot. lab., 1961-68[y]	(4.2	x	.579)	+	(-2.1	x	.421)	=	1.5	1.4

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

Over the full period unit residual cost was the positive component of the implicit price increase, with unit labour cost being a negative component. If unit production labour cost had held constant instead of declining to the extent indicated, implicit price rise would have been 1.0 percent per year instead of 0.5 (referring to column A); with respect to total labour over the full period, in the absence of any change in unit labour cost, implicit price would have increased 0.8 percent per annum instead of 0.6 percent. On the other hand, the opposite situation applies in the more recent period; unit labour cost increased while unit residual cost decreased. If unit residual cost had not changed between 1961 and 1968 instead of moving down, the three implicit price increases (in descending order of the three equations) would have been 1.4, 2.4 and again 2.4 percent.

Synthetic textile mills

Export and import trade are both important to this industry. Exports constituted 26.3 percent of the value of the industry's production in 1965, according to data especially compiled on that year for this study, while imports represented 27.8 percent of the value of total domestic market sales of the products of that industry (see Table 1). While some of the industry's output is sold to the consumer without further processing, more of it is supplied to manufacturers of clothing, upholstery and other commodities.

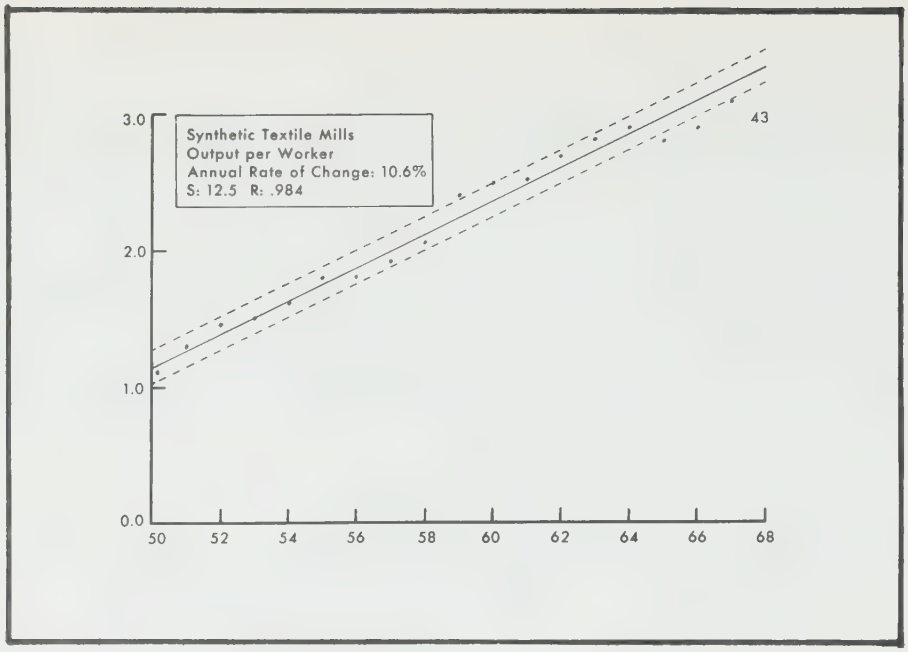
Synthetic textile mills (Standard Industrial Classification code 201) are primarily engaged in manufacturing yarns, threads and broad woven goods of synthetic textile fibres, including glass fibres as well as the manufacture of goods from natural silk, as well as those engaged in the extrusion of synthetic textile filaments. Because of the rapid changes in the kinds of products manufactured, the components of the industry were fully revised with the introduction of the new S.I.C. in 1960. However, there is no problem of continuity of data based on the old and new industry classification once the adjustments are made that are described in Appendix A.

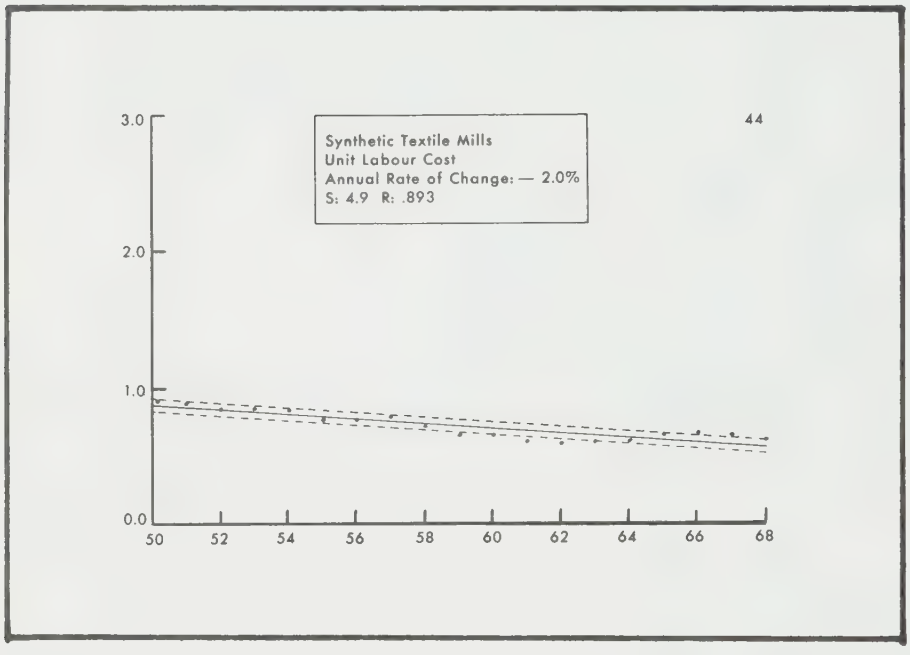
SYNTHETIC TEXTILES MILLS

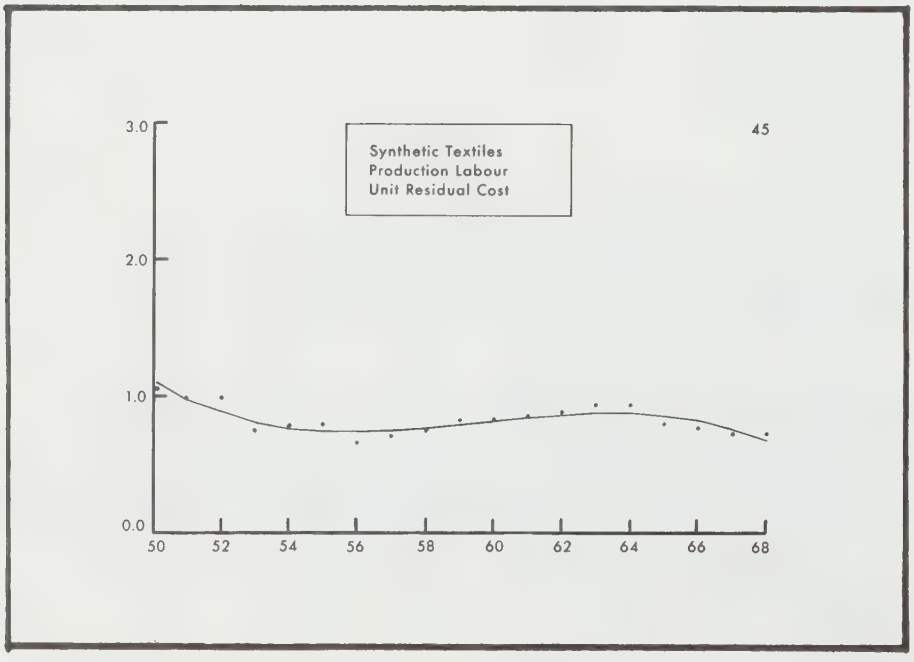
Summary Table – Principal Statistics

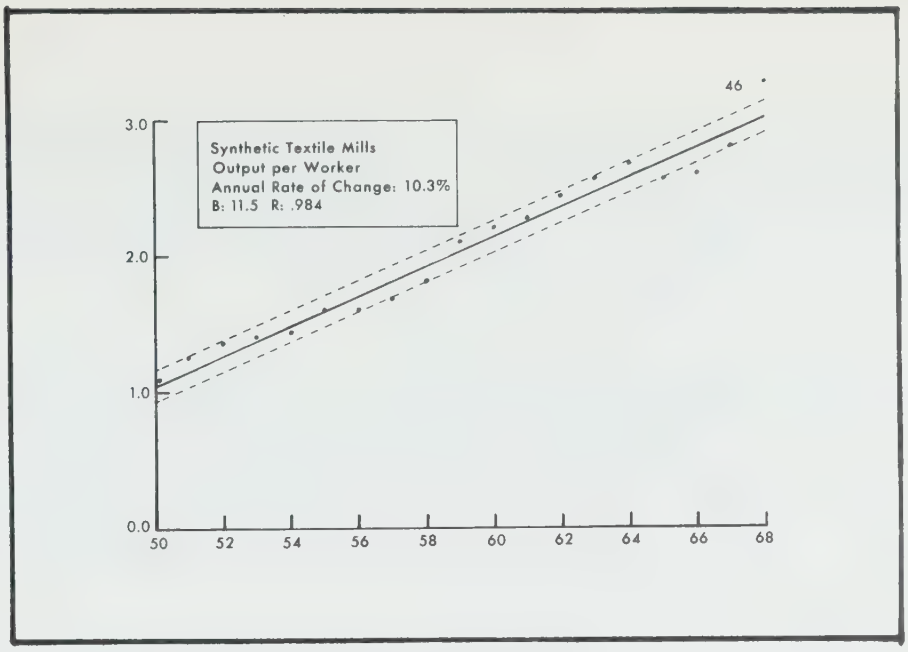
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			405.8			186.3			
Index of value added (1949 or 1961 = 100)			280.2			167.8		169.0	
Index of employment (1949 or 1961 = 100)	111.1	123.9		128.4	129.2				
Index of compensation per worker (1949 or 1961 = 100)	226.5	249.5		147.0	142.6				
Annual trend rate, compensation per worker	+5.0%	+6.1%		+6.3%	+6.1%				
Implicit, value-added price – index, 1949 or 1961 = 100)			69.0			90.1		90.7	
– Annual trend rate of change			−1.2%			−2.4%		−2.2%	
– R value			.682			.856		.850	
Output per worker – index, 1949 or 1961 = 100	365.1	327.6		144.9	144.2				
– Annual trend rate of change	+10.6%	+10.3%		+4.6%	+4.4%				
– R value	.984	.984		.818	.817				
Unit labour cost – index, 1949 or 1961 = 100	62.1	76.2		101.4	98.9				
– Annual trend rate of change	−2.0%	−1.4%		+1.3%	+1.4%				
– R value	.893	.853		.601	.613				
Unit residual cost – index, 1949 or 1961 = 100	73.1	62.6		85.4	82.0		82.8		
– Annual trend rate of change	−0.8%	−1.0%		−4.3%	−5.2%		−5.3%		
– R value	.351	.312		.882	.858		.863		
Payroll as a proportion of value added 1949	36.8%	47.8%							
1961				29.4%	48.0%		49.5%		
1968	33.1%	52.7%					54.0%		
Trend rate of change in labour share	−0.9%	−0.3%		+4.5%	+4.5%		+4.2%		
– R value	.492	.146		.878	.852		.846		
Trend rate of change in residual share	+0.5%	+0.3%		−2.3%	−3.3%		−3.4%		

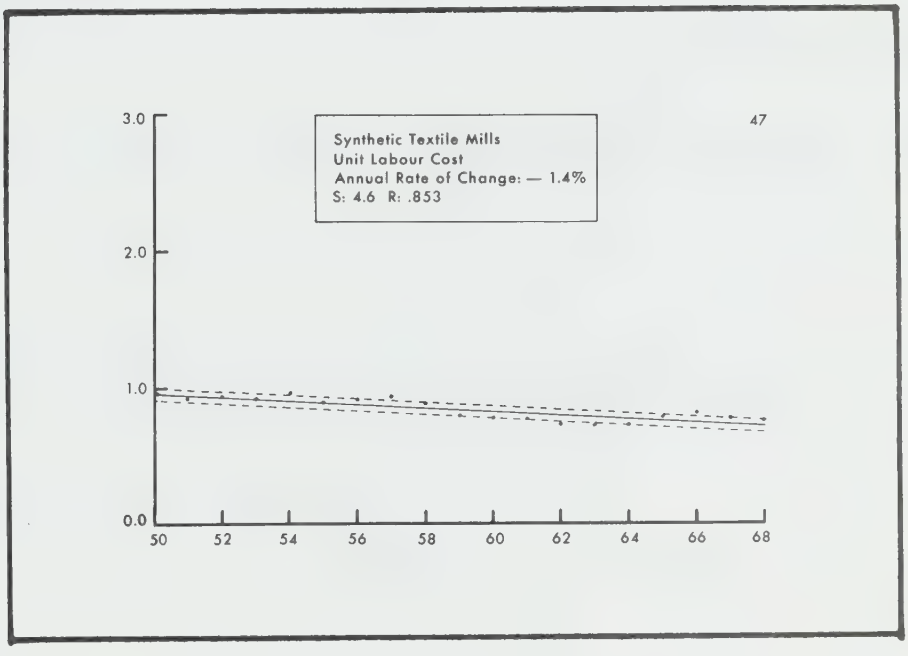
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

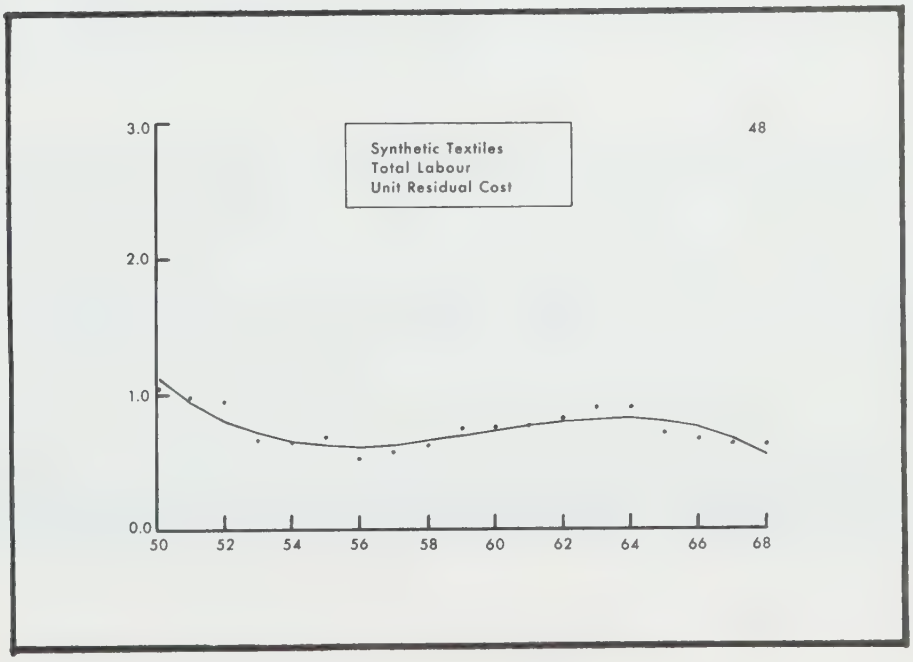

43
Synthetic Textile Mills
Output per Worker
Annual Rate of Change: 10.6%
S: 12.5 R: .984
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


44
Synthetic Textile Mills
Unit Labour Cost
Annual Rate of Change: — 2.0%
S: 4.9 R: .893
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


45
Synthetic Textiles
Production Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


46
Synthetic Textile Mills
Output per Worker
Annual Rate of Change: 10.3%
B: 11.5 R: .984
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


47
Synthetic Textile Mills
Unit Labour Cost
Annual Rate of Change: — 1.4%
S: 4.6 R: .853
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


48
Synthetic Textiles
Total Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Production increased much more than average over both the full and short periods, with only three of the industries studied showing greater increases in both periods, while one industry registered an almost identical increase in the short period. The increase of 305.8 percent between 1949 and 1968 is 79 percent greater than the 170.6 percent for all manufacturing and the 86.3 percent increase between 1961 and 1968 exceeds the all-manufacturing figure of 61.1 percent by 30 percent (see Table 2). The margin over the average, while still substantial, dropped considerably in the more recent years. While the industry's production increased 79 percent more than average, the increase in value added, at 180.2 percent, was 31 percent less than the average of 259.9 percent. However, over the 1961-1968 period the industry's increase, at 67.8 percent, almost matched that of all manufacturing at 71.0 percent.

Production worker and total labour employment increased less than average over the full period, production worker employment increased more than average between 1961 and 1968 and for total labour the increase was in line with the average. The full-period increase in production worker employment was 11.1 percent, compared with 27.2 percent for all manufacturing, for total labour it was 23.9 percent, compared with 32.8 percent; over the short period production worker employment rose by 28.4 percent, compared with 19.7 percent in all manufacturing, and total labour employment by 29.2 percent compared with 29.8 percent (see Table 3). There was a decline in the employment of production labour between 1949 and 1958, amounting to 25 percent over this period, and a gradual increase thereafter to 1968, amounting to 47 percent. Between 1949 and 1958 total labour employment dropped about 14 percent and from 1958 to 1968 increased 44 percent.

The proportion of production workers to total employment in the industry declined from 84.3 percent in 1949, slightly above the all-manufacturing proportion of 81.1 percent, to 75.6 percent in 1968, slightly less than 77.7 percent for all manufacturing. This is a 10.4 percent reduction in the proportion which showed a trend rate of decline of -0.3 percent. While these figures suggest that production labour was being displaced by nonproduction labour at a somewhat faster than average rate, the displacement was not as rapid as in many other industries, which can be seen in Table 5, and the proportions are just about in line with the average for all manufacturing.

Compensation (annual wages, annual wages and salaries) per worker increased less than average for both production and total labour between 1949 and 1968 and at about the average in the short period. Over the full period compensation per production worker increased 126.5 percent, compared with 161.5 percent for all manufacturing, and at an annual trend rate of 5.0 percent, compared with 7.2 percent for all manufacturing. Over the full period the increases for total labour were 149.5 percent compared with 166.5 percent for all manufacturing, and at an annual trend rate of 6.1 percent compared with 7.5 percent.

Between 1961 and 1968 compensation per production worker increased 47.0 percent, just a little more than the 43.9 percent for all manufacturing, and the annual trend rate of increase, at 6.3 percent, was exactly the same. For total labour the 1961-1968 increase was 42.6 percent, just slightly less than the 45.9 percent for all manufacturing, and the annual trend rate, at 6.1 percent, was also slightly less than that for all manufacturing, at 6.3 percent.

The full-period increase of 126.5 percent in annual wages per worker was matched by an identical increase in the index of occupational (hourly) wage rates, but the increase in average hourly earnings, at 157.6 percent, was significantly (25 percent) greater (see Table 9A). Between 1961 and 1968, the increases were more in line with each other, with annual wages per worker increasing 47.0 percent, occupational wage rates slightly less, at 44.3 percent, and average hourly earnings slightly more, at 51.1 percent. The reasons for different increases in these different measures of labour income are set forth in general terms in Chapter Six.

One difference between this industry and most of the others covered in this study is that the rate of increase in compensation per production worker was greater for the short period than over the full period, 6.3 compared to 5.0 percent, while for most of the industries and for all manufacturing, the rate was less in the short period. Similarly, the rate of increase with respect to total labour remained steady over both periods at 6.1 percent, while there was a reduction in most other cases, and for all manufacturing (see Table 11).

Implicit (value-added) price moved down through both the full and short periods and at a greater rate in the more recent period. This, of course, is to be expected since value added increased so much less than physical output. In 1968 implicit price was 31.0 percent less than in 1949 and 9.9 percent less than in 1961, contrasting with increases of 33.0 and 6.2 percent for all manufacturing (see Table 12). The annual trend rate of change was -1.2 percent for 1949-1968 and -2.4 percent for 1961-1968 compared with rates of increase of 1.0 and 0.9 percent for all manufacturing. One other industry had a rate of decrease over the full period as great as for synthetic textile mills but none, among the industries studied, showed a greater rate of decline; over the short period there was only one industry where implicit (value-added) price moved downward more rapidly, and this also applies to implicit price based on value added by total activity (see Table 16).

Between 1961 and 1968, while implicit price declined 9.9 percent with respect to value added, manufacturing and 9.3 percent related to value added, total activity, industry selling price declined somewhat less, at 6.9 percent. This may reflect higher costs of raw materials or of fuel and energy which are reflected in the industry selling price but not in value-added price. The consumer (retail) price index for synthetic textiles showed a 9.9 percent increase. All of the price increase to the consumer must be attributed to decisions and influences at the distribution and/or retail levels since retail price rose while price at the wholesale and manufacturing levels decreased.

Output per worker, for both production and total labour, increased substantially more than average over the full period and also more than average over the short period but by narrower margins. Between 1949 and 1968 there was an increase, with respect to production labour, of 265.1 percent, compared with 112.7 percent for all manufacturing, and, with respect to total labour, of 227.6 percent, compared with 103.7 percent for all manufacturing (see Table 17). Only two of the industries showed greater increases over this period. Between 1961 and 1968 the increase for production labour was 44.9 percent, compared with 34.6 percent for all manufacturing, and for total labour it was 44.2 percent, compared with 24.1 percent. During this period six other industries had increases that were as great or greater.

The annual trend rate of increase in output per production worker over the full period was 10.6 percent, 80 percent greater than the rate of 5.9 percent for all manufacturing. The rate for total labour, at 10.3 percent, was also almost 80 percent greater than the 5.8 percent all-manufacturing rate. Six industries had greater rates with respect to production labour and five industries with respect to total labour (see Table 19). The short-term annual trend rate for production labour, at 4.6 percent, was almost 25 percent greater than the all-manufacturing rate of 3.7 percent, and it was exceeded by the rates for seven other industries (it was six for the full period). For total labour the rate was 4.4 percent, about 13 percent greater than the 3.9 percent for all manufacturing, and the industry's rate was exceeded in seven other industries and one had the same rate (compared with five for the full period).

The high R values for both the full and short periods indicate a strong linear trend for production and total labour. However, as might be expected, there were some years of larger than normal increases, although an inspection of the charts reveals no important downward breaks in the steady rise of output per worker. Two spurts that might be mentioned occurred between 1958 and 1959 (16.5 percent) and 1967 and 1968 (18.6 percent) with respect to production labour and similarly for total labour in these years.

Over the full period unit production labour cost declined 37.9 percent, compared with an increase in all manufacturing of 23.0 percent (see Table 24). This was the result of a lower than average increase in compensation per worker combined with a greater than average increase in output per worker. No other industry covered by this study experienced as large a reduction between 1949 and 1968. The annual trend rate of decline was -2.0 percent, compared with an all-manufacturing rate of increase of 0.5 percent. Only one industry had a greater rate of decrease for unit production labour cost over this time period (see Table 26).

Over the short period there was a reverse from declining to increasing unit production labour cost. This resulted from an accelerated rate of increase in compensation per worker combined with a much reduced rate of increase in output per worker. However, the increase was less than average. Between 1961 and 1968 unit labour cost increased only slightly, by 1.4 percent, compared with 6.9 percent for all manufacturing, while the annual trend rate of increase was 1.3 percent, less than the 2.0 percent for all manufacturing. The apparent contradiction of a slight increase between 1961 and 1968 in the face of a trend rate of increase of 1.3 percent per annum can be understood from an examination of the chart and the data in Table 24. The low point in unit labour cost per production worker for the entire 1949-1968 period was 1962, which had a value about 3.5 percent less than 1961, the base year for the short-period analysis, and the high point thereafter was reached in 1966 when it was 13.5 percent greater than in 1962, which was then followed by lower values in 1967 and 1968, which is why the 1968 value is not much greater than that for 1961.

Unit labour cost with respect to total labour also declined over the full period but not as rapidly. The index in 1968 was 23.8 percent less than in 1949, compared with a 37.9 percent drop for production labour; however, the reduction of 23.8 percent contrasts with an increase in the same measure of 30.8 percent for all manufacturing. As with production labour, no other industry covered by this study had as large a reduction in unit labour cost over this period. The annual trend rate of decrease was -1.4 percent which, while not as great as the negative rate of -2.0 percent for production labour, is in contrast with a rate of increase of 0.7 percent for all manufacturing. As with production labour, only one industry registered a greater rate of decrease over the full period.

Over the short period, unit total labour cost increased, as did unit production labour cost. The annual trend rate of increase was 1.4 percent, just about the same as the 1.3 percent for production labour, and less than the 1.9 percent for all manufacturing. The fact that unit labour cost in 1968 was almost the same as in 1961, in spite of an annual rate of increase of 1.4 percent, results from exactly the same kind of year-to-year changes within this period that are described above with respect to production labour.

Unit residual cost declined over the full period but at a more moderate rate than unit labour cost. However, it moved downward much more rapidly during the short period when unit labour cost increased. Over the full period a nonlinear function more accurately indicates the movement of unit residual cost; the R values based on such a function are .884 and .888 with respect to production and total labour respectively instead of .351 and .312 when determined on the basis of a linear trend (see Appendix C).

In 1968 unit residual cost with respect to production labour was 26.9 percent less than in 1949, which compares with an increase over this period for all manufacturing of 38.9 percent (see Table 28). No other industry covered by this study showed such a large reduction over the full period. Nor, with respect to total labour, did any other industry have as large a reduction as the 37.4 percent in synthetic textile mills, which is in contrast with an increase of 35.1 percent for all manufacturing.

There was little indication of a linear trend over the full period because of fluctuations that can be discerned from the charts and Table 28. With respect to production labour, there was an almost unbroken decline from 1949 to 1956, amounting to 33.2 percent and from 1956 to 1963 there was an unbroken move upward, amounting to 40.4 percent, followed by a decline of 22.1 percent between 1963 and 1968. Similar but even stronger fluctuations occurred with respect to total labour, as follows: from 1949 to 1956, down 48.2 percent, 1956 to 1964, up 73.2 percent, 1964 to 1968, down 30.2 percent.

Over the short period the linear trend rates of decline of -4.3 and -5.2 percent with respect to production and total labour respectively, and value added, manufacturing, and of -5.3 percent with respect to total labour and value added, total activity, all had a good fit as indicated by the respective R values of .882, .858 and .863. However, because of the shift in direction in 1963 and 1964, described in the previous paragraph, the values in 1968 and not as much below 1961 as the negative annual trend rates for the period between those years would suggest. With respect to production labour, the 1968 index was 16.5 percent less and with respect to total labour, 17.9 percent less than in 1961 (both relative to value added, manufacturing).

Only one industry among those studied had a greater rate of decrease in unit residual cost with respect to production labour over the short period and, with respect to total labour, there were no such industries, but one had almost the same rate. With respect to total labour and value added by total activity, the rate of decline in synthetic textiles far exceeded the rates for the other industries showing a downward trend (see Table 31).

Because of the nonlinear movement of unit residual cost through the full period with its implications for factor shares, it is not surprising that the full-period trend for changes in shares does not enjoy a good fit when expressed in linear terms. Thus, the full-period annual trend rates of -0.9 and -0.3 percent for the production and total labour shares respectively are not very significant statistically.

What did happen is that the production labour share was 36.8 percent in 1949, was down to 29.4 percent by 1961 and up to 33.1 percent in 1968. As with unit residual cost, the annual trend rate of increase in the production labour share of 4.5 percent over the short period showed a good fit (R = .878). The total labour share was 47.8 percent in 1949, up slightly at 48.0 percent in 1961, and up much more to 52.7 percent in 1968. The total labour share of value added, manufacturing also increased at an annual trend rate of 4.5 percent and had a good fit (R = .846). These rates of increase of 4.5, 4.5 and 4.2 percent are much greater than the comparable all-manufacturing rates of 1.1, 1.0 and 0.2 percent, and in each case only one industry among those studied had a higher rate of increase.

The 1949 labour shares of 36.8 and 47.8 percent for production and total labour respectively were close to the 36.8 and 48.6 percent for all manufacturing. In 1968 the production labour share, at 33.1 percent, was still close to the 34.0 percent for all manufacturing but the total labour share, at 52.7, had moved up relative to the all-manufacturing figure of 47.8 percent, which was more the case when total labour was related to value added by total activity in that the 1968 share was 54.0 percent in the industry and 46.1 percent in all manufacturing. With the shares in this industry so closely approximating those for all manufacturing, it follows that many of the industries studied were more labour intensive and others were less so.

The strong fluctuations in factor shares mean that current-weighted computations of changes in the residual share can be expected to differ from the base-weighted computations used for our analysis. (The reasons for the differences are, it will be recalled, explained in Chapter Nine.) The interested reader may obtain comparative data upon request from the Canada Department of Labour, Economics and Research Branch.

The composition of implicit (value-added) price for synthetic textile mills is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-2.0	x	.368)	+	(-0.8	x	.632)	=	-1.2	-1.2
Tot. lab., 1949-68[x]	(-1.4	x	.478)	+	(-1.0	x	.522)	=	-1.2	-1.2
Prod. lab., 1961-68[x]	(1.3	x	.294)	+	(-4.3	x	.706)	=	-2.7	-2.4
Tot. lab., 1961-68[x]	(1.4	x	.480)	+	(-5.2	x	.520)	=	-2.0	-2.4
Tot. lab., 1961-68[y]	(1.4	x	.495)	+	(-5.3	x	.505)	=	-2.0	-2.2

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

Over the 1949-1968 period, while both unit cost series moved downward, which means that implicit price had to be declining, unit labour cost constituted the greater part of the price change. If unit labour cost had remained constant (that

is, the trend rate was zero), in each case implicit price would have declined at a rate of -0.5 percent instead of -1.2 percent. However, over the more recent period, while unit residual cost moved downward even more rapidly than over the full period, unit labour cost moved upward. In the first such instance, if unit labour cost had not changed, implicit price would have declined at a rate of -3.0 percent rather than -2.7 percent and in the second and third instances, at a rate of -2.7 percent instead of 2.0 percent.[13]

A study of productivity in synthetic textile mills appears in a report covering two other industries as well, published by the Dominion Bureau of Statistics in 1966, covering 1947 to 1961.[14] Some aspects of this report have already been discussed at the conclusion of the section on breweries (see page 218) and what is said there applies in this instance as well. It might just be added that this and other studies of this nature by D.B.S., later Statistics Canada, examine the components of output and labour productivity in terms of some of the more important processes and products. For reasons explained in earlier parts of this study, it is not our purpose to examine the components of productivity change, as important as such an examination can be, but to treat productivity as an element in factor costs of production that are related to price change. Our report is more up-to-date now than the D.B.S. report just cited but aside from that, our study and those of D.B.S.-Statistics Canada, in examining different aspects of related phenomena, are similar. However, Statistics Canada is in no way responsible for this study, nor do they necessarily agree with us on all aspects of our methodology and conclusions.

Clothing industries

This industry[15] experienced much below average increases in production and employment, below average increases in compensation per worker and output per worker, above average increases in unit labour cost, for the most part, above average increases in unit residual cost, and, as must follow, above average increases in implicit (value-added) price.

Foreign trade is not of much importance to the industry. Based on estimates for 1965 (see Table 1), only 0.9 percent of the value of output was exported, while 5.3 percent of the value of total market sales of the products of the industry were imports. The importance of the industry to the domestic market and directly to the consumer is indicated by the fact that 7.6 percent of the consumer price index is accounted for by men's, women's and children's wear.

The clothing industries covered in this study consist of all the industries in Major Group 7 (Clothing Industries) of the Standard Industrial Classification except the first one (custom tailoring shops). They comprise men's clothing (S.I.C. code 243), women's clothing (S.I.C. code 244), children's clothing (code 245), fur goods (code 246), hat and cap industry (code 247), foundation garments (code 248), and other clothing (code 249). Descriptions of the activities and principal products of each industry can be found on page 30 of the S.I.C. manual (cited previously). The introduction of the new S.I.C. in 1960 did not introduce any serious breaks in data in the component groups although adjustments, as described in Appendix A, were necessary to maintain continuity in some of the series.

Only two of the industries studied had smaller increases in production between 1949 and 1968 but between 1961 and 1968 there were five such industries. The full-period increase of 62.1 percent was 64 percent below the increase of 170.6 percent for all manufacturing, and the short-period increase of 25.0 percent was 60 percent below the 61.1 percent for all manufacturing (see Table 2). During the period covered by this study, the industry did not improve its position relative to all manufacturing.

The full-period increase in value added by manufacturing was also below average, but somewhat less than was the case with production; at 122.7 percent it was 53 percent less than the increase of 259.9 percent for all manufacturing. Over the more recent period (1961-1968) the increase for this industry moved closer to that for all manufacturing; at 58.5 percent it was 18 percent below the increase of 71.0 percent for all manufacturing. The increase over this period of value-added by total activity was, at 58.7 percent, 25 percent less than the 78.1 percent increase for manufacturing as a whole. While three of the industries studied had smaller increases between 1949 and 1968 in value-added by manufacturing, there were eight such industries for the period, 1961 to 1968.

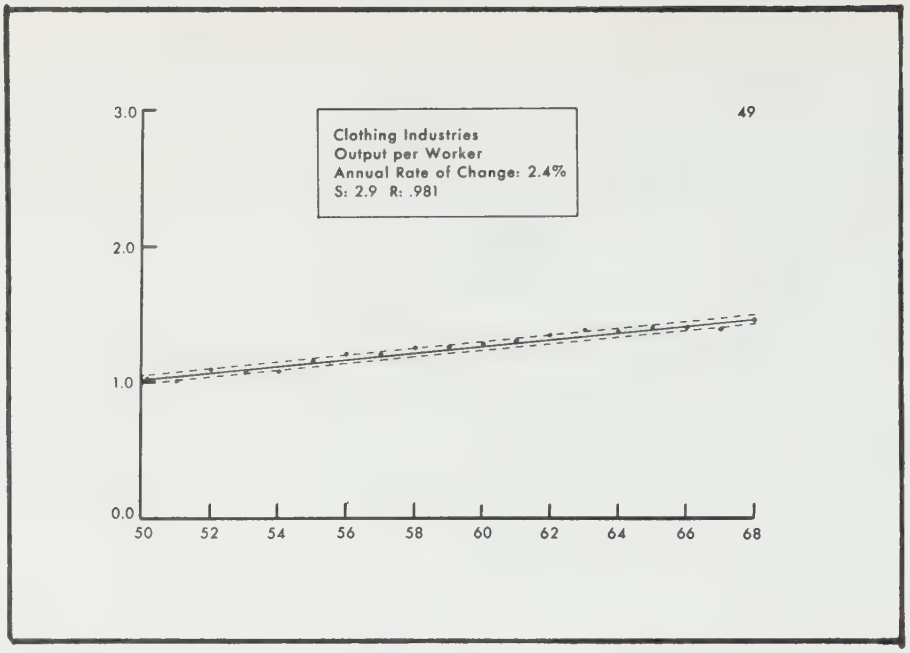
Employment of both production and of total labour increased much less than average over both periods. The production labour increase of 11.1 percent over the full period was 60 percent less than the 27.2 percent for all manufacturing (see Table 3). However, many other industries among those studied registered either smaller increases or actual decreases in employment. One rather unusual feature of this industry is the increase through 1949 to 1968 in the proportion of production labour to total employment (see Table 5). The proportion, at 93.3 percent in 1968, was 8.6 percent greater than in 1949. Only three of the other industries studied showed an increase. The annual trend rate of increase of 0.5 percent was a strong one, indicated by the high R value (.89). In 1949 the production labour proportion at 85.9 percent, was somewhat higher than the all-manufacturing proportion of 81.1 percent, but by 1968 the proportion of 93.3 percent was not only 20 percent greater than that for all manufacturing but was the highest for any of the industries.

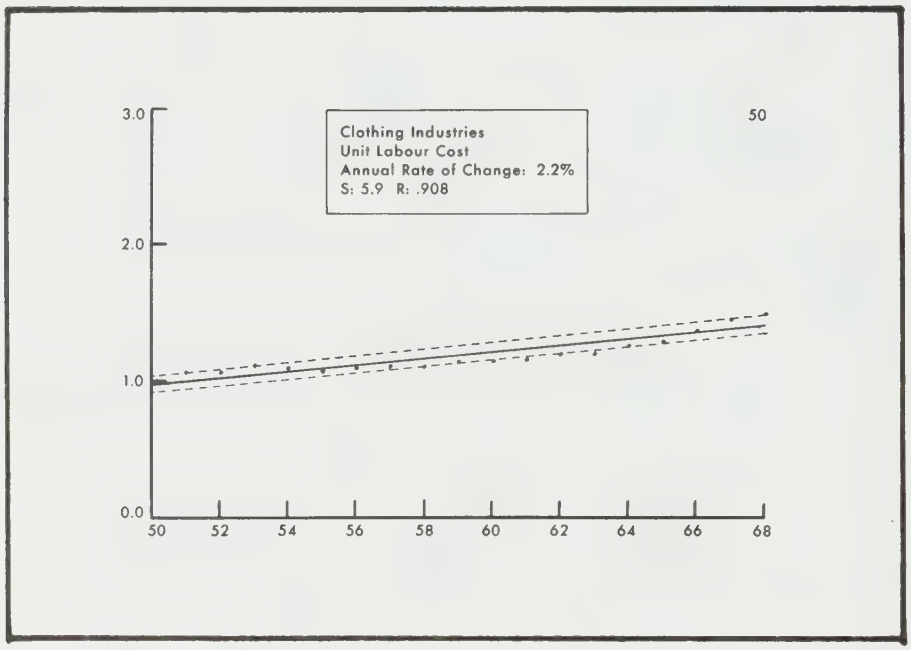
Over the full period compensation (annual wages, annual wages and salaries) per worker increased considerably less than average and while the 1961-1968 percentage increases were more in line with those in all manufacturing, the annual trend rates of change were still below average.

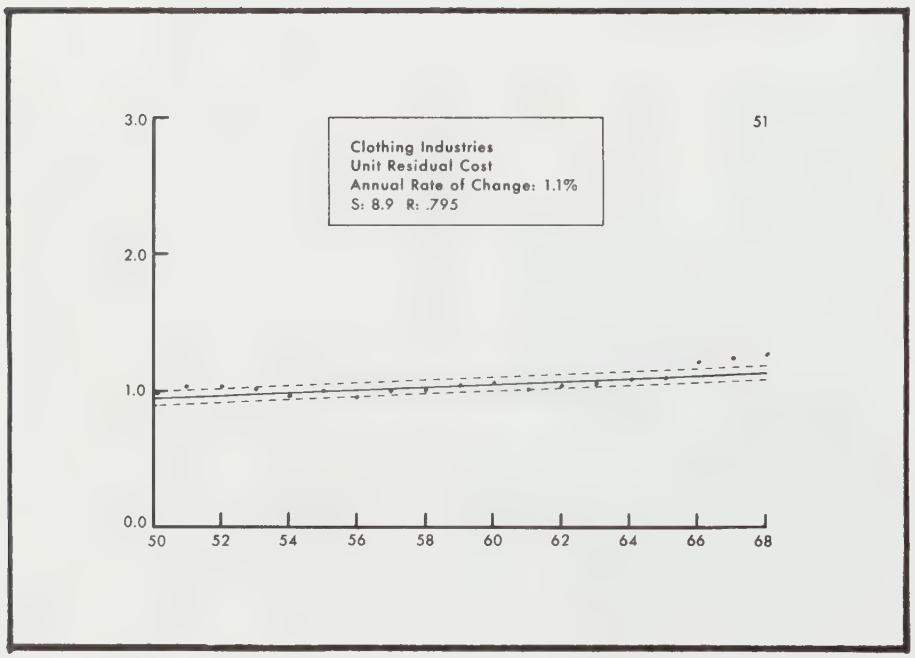
Summary Table — Principal Statistics

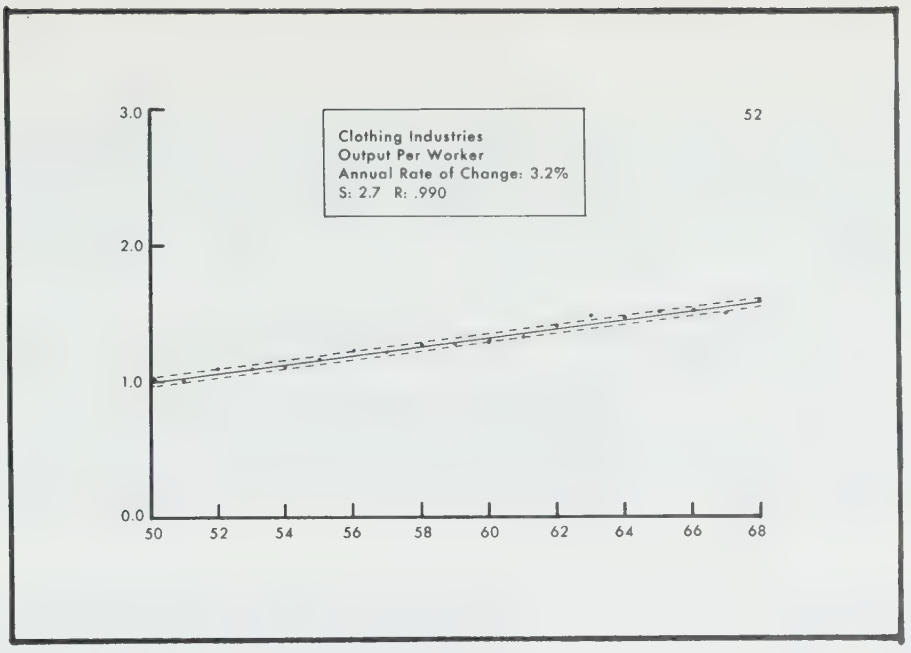
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			162.1			125.0			
Index of value added (1949 or 1961 = 100)			222.7			158.5		158.7	
Index of employment (1949 or 1961 = 100)	111.1	102.3		111.3	104.6				
Index of compensation per worker (1949 or 1961 = 100)	219.5	213.2		145.1	141.4				
Annual trend rate, compensation per worker	+6.0%	+5.6%		+4.7%	+5.7%				
Implicit, value-added price — index, 1949 or 1961 = 100			137.3			126.8		126.9	
— Annual trend rate of change			+1.8%			+4.5%		+4.6%	
— R value			.867			.975		.974	
Output per worker — index, 1949 or 1961 = 100	145.9	158.4		112.3	119.5				
— Annual trend rate of change	+2.4%	+3.2%		+0.9%	+1.6%				
— R value	.981	.990		.825	.915				
Unit labour cost — index, 1949 or 1961 = 100	150.5	134.6		129.2	118.3				
— Annual trend rate of change	+2.2%	+1.4%		+3.5%	+3.7%				
— R value	.908	.881		.613	.964				
Unit residual cost — index, 1949 or 1961 = 100	127.1	141.5		124.7	140.5		141.7		
— Annual trend rate of change	+1.1%	+2.2%		+5.3%	+5.0%		+6.0%		
— R value	.795	.823		.761	.951		.973		
Payroll as a proportion of value added 1949	44.2%	58.9%							
1961				47.6%	61.8%		62.9%		
1968	48.4%	57.7%					58.6%		
Trend rate of change in labour share	+0.4%	−0.2%		−0.7%	−0.5%		−0.7%		
— R value	.854	.519		.154	.570		.871		
Trend rate of change in residual share	−0.5%	+0.3%		+0.6%	+0.6%		+1.0%		

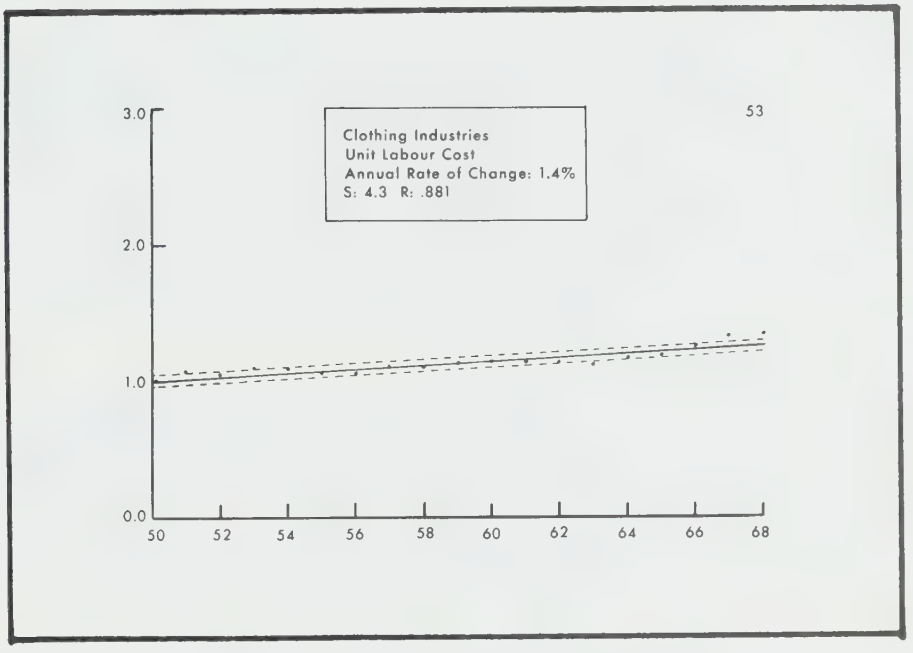
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

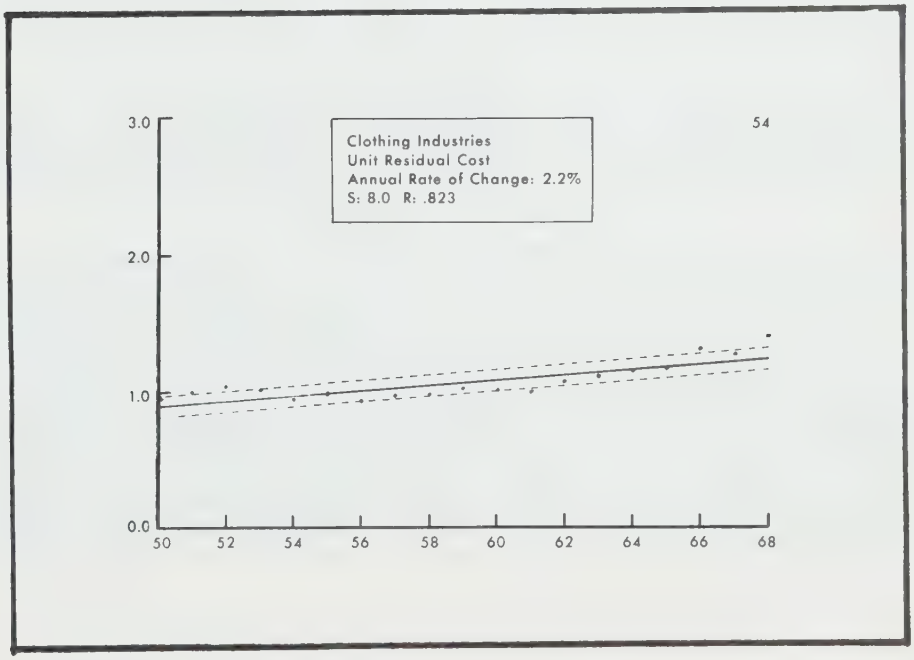

49
Clothing Industries
Output per Worker
Annual Rate of Change: 2.4%
S: 2.9 R: .981
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


50
Clothing Industries
Unit Labour Cost
Annual Rate of Change: 2.2%
S: 5.9 R: .908
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


51
Clothing Industries
Unit Residual Cost
Annual Rate of Change: 1.1%
S: 8.9 R: .795
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


52
Clothing Industries
Output Per Worker
Annual Rate of Change: 3.2%
S: 2.7 R: .990
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


53
Clothing Industries
Unit Labour Cost
Annual Rate of Change: 1.4%
S: 4.3 R: .881
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


54
Clothing Industries
Unit Residual Cost
Annual Rate of Change: 2.2%
S: 8.0 R: .823
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Production labour compensation per worker in the industry in 1968 was 119.5 percent greater than in 1949 but this fell 26 percent behind the increase of 161.5 percent for all manufacturing (see Table 9A). The annual trend rate of increase, at 6.0 percent, was 17 percent less than the rate of 7.2 percent for all manufacturing. Only two of the industries studied had lower rates of increase (see Table 11). Between 1961 and 1968 there was an increase of 45.1 percent, slightly more than the 43.9 percent for all manufacturing, while the annual rate of increase, at 6.1 percent, was slightly less than the rate for all manufacturing of 6.3 percent.

Total labour compensation per worker increased 113.2 percent between 1949 and 1968, which was 32 percent less than the 166.5 percent increase in all manufacturing. The annual trend rate of increase over the full period, at 5.6 percent, was 25 percent less than the 7.5 percent for all manufacturing. Only one industry had a lower rate and one other had an identical rate. There was a 41.4 percent increase between 1961 and 1968, slightly less than the 45.9 percent for all manufacturing, and the annual trend rate, at 5.7 percent, was slightly higher than the 5.6 percent for the full period, in contrast with a reduced rate for production labour, but it fell almost ten percent behind the rate for all manufacturing while the gap for production labour only was greater, at 25 percent. Eight industries had lower trend rates of increase and one industry had an identical rate (see Table 11).

Annual wages per worker and occupational wage rates increased to an almost identical extent between 1949 and 1968, 119.5 percent for the former and 119.1 percent for the latter, while average hourly earnings increased slightly more at 127.6 percent (see Table 9A). Between 1961 and 1968 annual wages and annual hourly earnings increased to almost the same extent, by 45.2 percent and 44.2 percent respectively, while occupational wage rates increased somewhat less, at 35.7 percent.

Implicit (value-added) price in 1968 was 37.3 percent higher than in 1949, an increase that was close to the 33.0 percent for all manufacturing (see Table 12). However, the annual trend rate, at 1.8 percent, was notably higher than the 1.0 percent for all manufacturing. The higher trend rate for this industry, compared with a similar 1949-1968 percentage increase, arises from the fact that the rise in all manufacturing followed a rather smooth upward trend, while most of the increase in the clothing industries occurred between 1961 and 1968. The all-manufacturing index in 1961 was 25.2 percent above that for 1949 while the index for this industry was only 8.3 percent higher. Then, between 1961 and 1968 implicit price moved up 26.8 percent, compared with only 6.2 percent for all manufacturing. The short-period annual trend rate of increase was 4.5 percent, much higher than the full-period rate of 1.8 percent and the rate for the same period for all manufacturing of 0.9 percent. Only one industry had a greater short-period annual rate of increase. Implicit price in relation to value added by total activity performed much the same as the measure related to value added, manufacturing.

There is no industry selling price index for clothing industries as such which can be compared with the implicit price indexes just discussed. Indeed, such an index is available only for men's clothing, and it would be inaccurate and misleading to compare the implicit price trend for the whole group of industries with the industry selling price movement for only one component industry. However, there is a consumer (retail) price index for clothing, which increased 21.1 percent between 1961 and 1968, compared with an implicit price increase of 26.8 percent relative to value added by manufacturing activity and virtually the same, 26.9 percent relative to value added by total activity. Part of the higher price of the industry's output at the manufacturing level must have been absorbed at the wholesale and/or retail levels or lower costs of raw materials or fuel and energy offset some of the rise in implicit price.

Output per worker increased less than average over both the full and short periods and the annual trend rates of increase were much more below average over the more recent period. In most manufacturing industries the rate was lower for 1961-1968 than for 1949-1968, but the difference was more pronounced in this industry. However, if differences between base and terminal years are considered, the contrast with all manufacturing is not the same.

The increase of 45.9 percent in output per production worker between 1949 and 1968 was 60 percent less than the increase of 112.7 percent in all manufacturing, while the increase of 12.3 percent between 1961 and 1968 was 65 percent below that of 34.6 percent for all manufacturing (see Table 17). When the increases are measured in relation to total labour, the 1949-1968 increase of 58.4 percent was 44 percent below the 103.7 percent for all manufacturing while the 1961-1968 increase of 19.5 percent was only 19 percent less than the rise of 24.1 percent in all manufacturing.

The annual trend rate of increase over the full period was 2.4 percent for production labour, about 60 percent below the all-manufacturing rate of 5.9 percent; the rate for total labour was 3.2 percent, 45 percent less than that for the whole of manufacturing, these differences being almost identical with the differences between 1949 and 1968 described above. The short-period trend rate of increase of 0.9 percent per annum for production labour was 76 percent less than the 3.7 percent for all manufacturing, compared with a difference of 65 percent in the respective increases between 1961 and 1968. With respect to total labour, the annual rate of 1.6 percent was 59 percent less than the 3.9 percent for all manufacturing, compared with a difference of only 19 percent in the respective increases between 1961 and 1968.

Analysis based on 1968 relative to 1961, having in mind a sudden jump in productivity between 1967 and 1968, naturally produces a different impression from that based on trend rates where all the year-to-year increases through the period are taken more fully into account.

The fact that output per worker for total labour increased at an annual rate over the full period one-third faster than the rate for production labour only (3.2 compared with 2.4 percent, both rates highly significant statistically) contrasts with a slightly lower rate of increase for total, compared with production labour in all manufacturing. While in all manufacturing, as in this industry, the increase for total labour exceeded that for production labour, the difference was much greater in this industry. Over the full period the annual rate of increase for total labour exceeded that for production labour in only six industries covered in this study; over the short period the number of such industries was ten (see Table 19). Over the full period lower rates of increase in output per worker for both production and for total labour than those in the clothing industry were found in only three industries; over the short period there was only one such industry with respect to production labour and two others that had the same rate, while for total labour three industries had lower rates of increase.

Unit labour cost increased much more than average in this industry over both the full and short periods. This is a result of the lower than average increases in labour productivity combined with increases in compensation per worker that, while less than average, were not as much so as the increases in productivity. (This is understandable enough; long-term forces of the labour market make for greater uniformity in long-run wage increases among industries, while differences in technology, capital investment, industrial organization, etc. make for greater interindustry variations in productivity.)

The contrast between this industry and all manufacturing is much less when increases between 1949 and 1968 and 1961 and 1968 are compared, rather than annual trend rates. Between 1949 and 1968 unit labour cost with respect to production labour increased 50.5 percent, or 120 percent more than the 23.0 percent increase for all manufacturing (see Table 24). Over the same period the increase for total labour was much less; at 34.6 percent, it was only 12 percent greater than the 30.8 percent for all manufacturing. Between 1961 and 1968 unit production labour cost increased 29.2 percent, or some 323 percent more than the all-manufacturing increase of only 6.9 percent, while the increase for total labour of 18.3 percent was almost identical with the 17.6 percent increase for all manufacturing, being only four percent greater. For total labour the increases over both periods were virtually the same as in all manufacturing, but in strong contrast, there was a considerable difference with respect to production labour, which widened greatly in the short period.

The full-period annual trend rate of increase at 2.2 percent for production labour was 4.4 times as great as the 0.5 percent for all manufacturing and the rate for total labour, at 1.4 percent, was twice the 0.7 percent for all manufacturing. The difference between the trend rates for this industry and all manufacturing narrowed in the short period for production labour but remained about the same for total labour. The rate of 3.5 percent for production labour was 1.75 times greater than the 2.0 percent for all manufacturing, a drop from a difference of more than four times over the full period. The rate of 3.7 percent for total labour was almost twice the rate of 1.9 percent for all manufacturing, the same difference as over the full period.

The full-period rate of increase in unit labour cost for production labour, at 2.2 percent, was more than 50 percent greater than the rate for total labour, whereas in all manufacturing the rate for total labour was greater than that for production labour. For the short period the situation in this industry was once again reversed from that in all manufacturing; the rate for production labour, at 3.5 percent, was slightly less than the 3.7 percent for total labour.

In only three of the industries studied did unit labour cost for production labour increase over the full period at a faster rate than in this one, and in six industries in the case of total labour; for the short period there were four such industries with respect to production labour and five for total labour.

Unit residual cost rose even more than unit labour cost over both periods with respect to both production and total labour and (with one exception that is noted in the next sentence) more than the comparable rates for all manufacturing. The full-period increase in unit residual cost with respect to production labour was 27.1 percent, considerably less than the increase of 38.9 percent in all manufacturing (see Table 28). The annual trend rate, at 1.1 percent, was also less than the 1.3 percent for all manufacturing. But when total labour is taken into account, the increase was not only greater than for production labour only but higher than for all manufacturing. Between 1949 and 1968 there was an increase of 41.5 percent, somewhat higher than the 35.1 percent for all manufacturing; but the notable difference is in the annual trend rate of increase which, at 2.2 percent, was double the 1.1 percent relative to production labour, and close to twice the rate of 1.2 percent for all manufacturing.

Since nonproduction labour is included in the measures related to total labour, the best distinction between increase in labour and nonlabour cost is through the measures related to total labour. The annual trend rate of increase, relative to total labour, over the full period was 1.4 percent in unit labour cost and 2.2 percent in unit residual cost. In other words, nonlabour cost was increasing more than labour cost.

Unit residual, like unit labour cost, had higher rates of increase in this industry over the more recent, short period. An acceleration of unit labour cost in the recent period was the case for all manufacturing as well but the rate of change in unit residual cost shifted to a position of no net change; with respect to both production and total labour, the computed linear trend rates had no statistical significance. This stands out against marked increases in the clothing industries.

Between 1961 and 1968 unit residual cost with respect to production labour increased 25.0 percent, compared with only 5.7 percent in all manufacturing. The annual trend rate of increase was 5.3 percent compared with only 1.1 percent over the full period. The annual trend rate is greater than would be suggested by the percentage difference between 1961 and 1968 values, because of larger year-to-year increases from 1966 to 1968 than occurred between 1961 and 1965 (see the chart for unit residual cost, production labour, and Table 28).

With respect to total labour, unit residual cost increased 40.5 percent over the short period, which is consistent with the annual trend rate of increase of 5.0 percent; the upward trend followed a smoother path than that with respect to production labour, described in the preceding paragraph. The 40.5 percent increase between 1961 and 1968 compares with a 1.2 percent decrease for all manufacturing.

While ten of the industries studied had higher rates of increase in unit residual cost with respect to production labour over the full period, there were only two such industries in the short period; with respect to total labour, there were five such industries in the full period and three in the short period. It should also be pointed out that over the full period the measure related to total labour increased more than that related to production labour; however, over the short period, the measure related to production labour had the greater increase because unit labour cost with respect to total labour increased more than that for production labour, meaning that nonproduction labour cost was rising more than that for production labour. Because unit residual cost relative to production labour still contains nonproduction labour cost (but not that for production labour) and it was increasing faster than unit residual cost relative to total labour (containing only nonlabour cost), it follows that nonproduction labour cost was increasing not only more than production labour cost but also more than nonlabour cost.

This industry experienced higher than average increases in costs and implicit price, although it must be emphasized, as it has been throughout this study, that without systematic research into all relevant factors, it does not necessarily mean that the price was pushed up by costs.

The labour and residual shares of value added were quite stable over the years covered by this study. The production labour share was 44.2 percent in 1949, 47.6 percent in 1961, 48.4 percent in 1968. This indicates a steady but quite moderate rise, which happens to be at an annual trend rate of increase of 0.4 percent (the steadiness of the rise indicated by the R value of .854). The labour share was at its maximum in 1968 and the minimum in 1949, also indications of a steady rise, but the difference, at 9.5 percent, is the smallest for any of the industries studied and compares with 16.1 percent for all manufacturing and an average of 51.3 percent for the industries studied (see Table 38A). The short-period annual trend rate of increase of 0.2 percent differed little from the full-period rate.

This was one of the most labour-intensive industries among those studied. The 1949 production labour share of 44.2 percent was exceeded in only four industries and another industry showed the same labour share, while only three industries had larger total labour shares than the 58.9 percent in this industry in 1949. The 44.2 and 58.9 percent compare with 36.8 and 48.6 percent in all manufacturing.

Contrary to production labour, the total labour share did decline, but very slightly, between 1949 and 1968, and, in fact, only in 1966 and in 1968 itself was the labour share smaller than in 1949. As with production labour, the share held comparatively steady through the whole period, the difference of 8.4 percent between the minimum and maximum values being the second smallest of that for any of the industries and much less than the difference of 14.6 percent for all manufacturing and an average difference of 40.1 percent for the industries studied (see Table 38B). While the apparent 1961-1968 decline in the production labour share is illusory, the annual trend rate of decline of -0.5 percent for total labour over this period does reflect a more definite downtrend with the 1968 value some seven percent (and four percentage points) less than in 1949 (see Table 34, column B).

The total labour share of value added by total activity was somewhat larger than the share related to value added, manufacturing in both 1961 and 1968, and it decreased somewhat more quickly (see Summary Table).

The composition of implicit (value-added) price for the clothing industries is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(2.2	x	.442)	+	(1.1	x	.558)	=	1.6	1.8
Tot. lab., 1949-68[x]	(1.4	x	.589)	+	(2.2	x	.411)	=	1.7	1.8
Prod. lab., 1961-68[x]	(3.5	x	.476)	+	(5.3	x	.524)	=	4.4	4.5
Tot. lab., 1961-68[x]	(3.7	x	.618)	+	(5.0	x	.382)	=	4.2	4.5
Tot. lab., 1961-68[y]	(3.7	x	.629)	+	(6.0	x	.371)	=	4.6	4.6

x – related to value added manufacturing
y – related to value added total activity
A – as calculated from this equation
B – as calculated by computer (see Table 16)

In the first equation unit labour cost is clearly the major component of implicit price change because, while the weight is somewhat smaller than that for unit residual cost, the rate of increase is double that for unit residual cost. Sixty percent of the implicit price change consists of the unit production labour cost factor. In the second equation, the residual labour elements are more even, but residual is the principal element, accounting for 53 percent of implicit price change. In the third equation residual is the major element, constituting 63 percent of implicit price change, in the fourth equation labour is slightly larger than the residual at 54 percent, and in the final equation the two are almost even, with unit labour cost constituting 51 percent.

Furniture and fixtures

Export markets have not been important to this industry nor has import competition; at least, not on the basis of data on 1965 prepared for this study (see Table 1). In that year exports accounted for only 1.6 percent of the value of the industry's output and imports only 5.3 percent of the value of total market sales. While much of the industry's output supplies the needs of commercial organizations, institutions, government and the like, furniture accounts for 1.9 percent of the consumer price index.

The furniture and fixture industries (which for simplicity's sake are herein called an industry) constitute major group 9 of the Standard Industrial Classification and consist of: the household furniture industry (S.I.C. code 261) which, in addition to the manufacture of all kinds of household furniture and materials, includes upholstery, cabinet-making and furniture repairing shops; the office furniture industry (S.I.C. code 264) consisting of the manufacture of office furniture such as desks, chairs, tables, filing cabinets of all kinds and all materials; other furniture industries (S.I.C. code 266) including the manufacture of store furniture and fixtures, public building and professional furniture and fixtures of all kinds and materials, as well as the manufacture of mattresses and springs; and the electric lamp and shade industry (S.I.C. code 268), consisting of the manufacture of electric table and floor lamps and shades of all types and materials (but electrical fixtures are not included here). (The establishments coded to the industries just described must have the operations described as their primary activity; otherwise, they are coded according to where they belong in terms of their primary activity.)

The introduction of the new S.I.C. in 1960 meant some regrouping of the components described above. Electric lamps and shades had been part of miscellaneous industries, not elsewhere specified which were in turn part of miscellaneous manufacturing industries, while furniture repair had, under the 1948 S.I.C., been part of 'other goods not elsewhere classified.' However, continuity of data on the old and new classifications has been possible through the adjustments described in Appendix A.

This industry had slightly greater than average increases in production and value added over both the full (1949-1968) and short (1961-1968) periods, greater than average increases in production worker employment over both periods as well as for total labour employment over the full period, and an average increase for total labour over the short period; slightly lower than average increases in annual compensation per worker over both periods, slightly lower than average increases in output per worker over the full period and slightly greater than average over the short period. Unit labour cost increases were mostly below average, while unit residual cost and implicit (value-added) price increases were all greater than average. There was a definite reduction in the labour share of value added for both kinds of labour and over both time periods.

Between 1949 and 1968 production increased 186.1 percent, about one-tenth more than the 170.6 percent for all manufacturing, and between 1961 and 1968 the increase of 66.8 percent was again about one-tenth more than the 61.1 percent for all manufacturing (see Table 2). The full-period increase of 286.1 percent in value added by manufacturing was just ten percent greater than the increase of 259.9 percent for all manufacturing, while the increase of 88.4 percent over the short period had widened the margin to almost 25 percent over the 71.0 percent increase for all manufacturing. Over the short period value added by total activity increased 87.8 percent, compared with 78.1 percent in all manufacturing.

Production worker employment increased 44.7 percent between 1949 and 1968, which was almost two-thirds greater than the comparable increase of 27.2 percent in all manufacturing; such employment increased 31.3 percent between 1961 and 1968 or 59 percent more than the 19.7 percent for all manufacturing (see Table 3). Over the full period the employment of total labour increased 49.1 percent, or 50 percent more than the 32.8 percent in all manufacturing, but over the short period the increase in this industry, at 29.4 percent, was virtually the same as the 29.8 percent for all manufacturing. Between 1949 and 1968 the production worker proportion of total employment declined slightly, from 84.8 to 82.3 percent, but a significant trend towards the employment of relatively less production labour was not apparent (see Table 5).

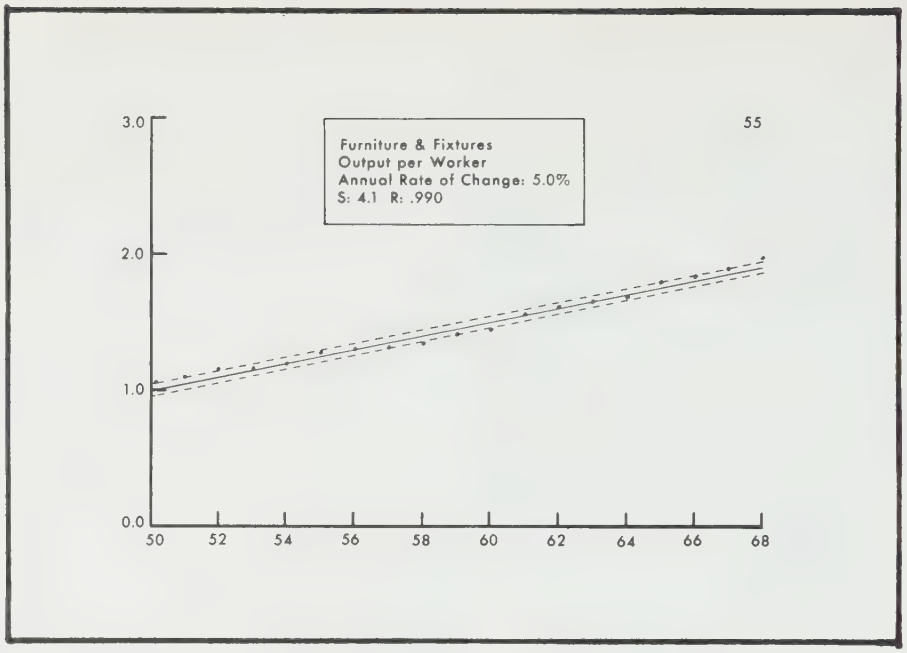
Compensation (i.e. annual wages) per production worker increased 142.8 percent over the full period, or 12 percent less than the all manufacturing increase of 161.5 percent; over the short period the increase was closer to the average, 41.7

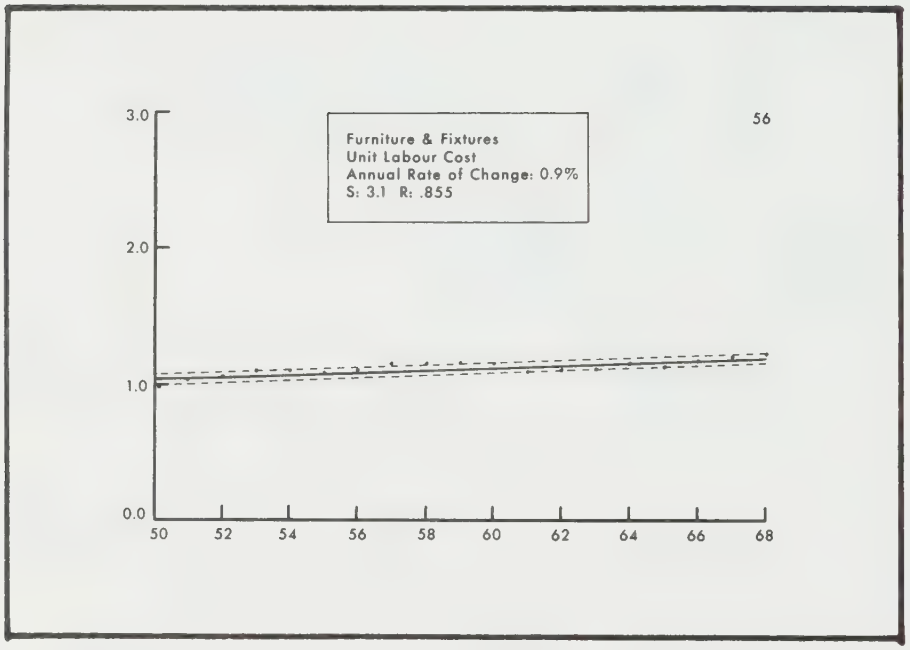
FURNITURE AND FIXTURES

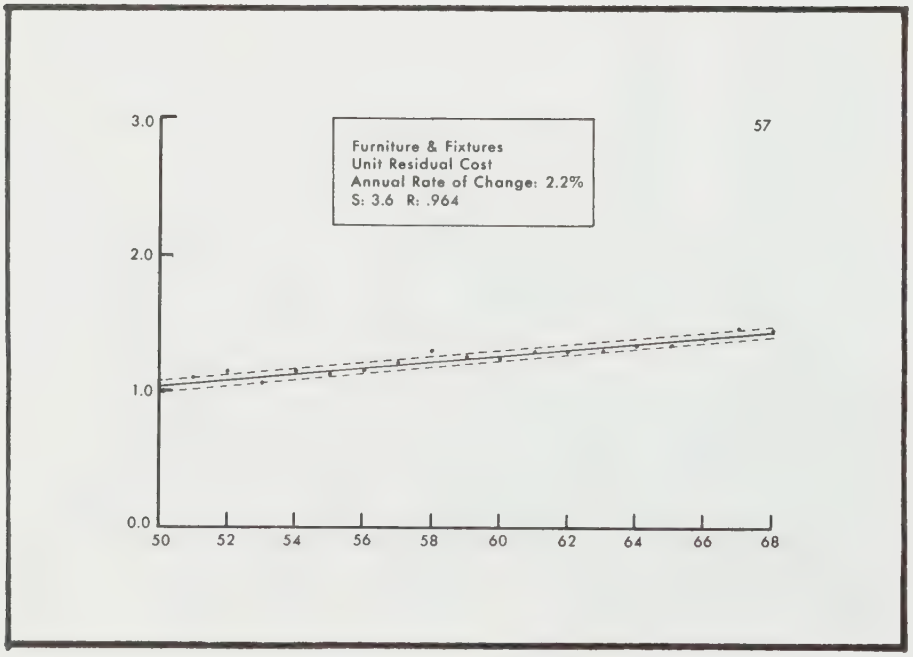
Summary Table – Principal Statistics

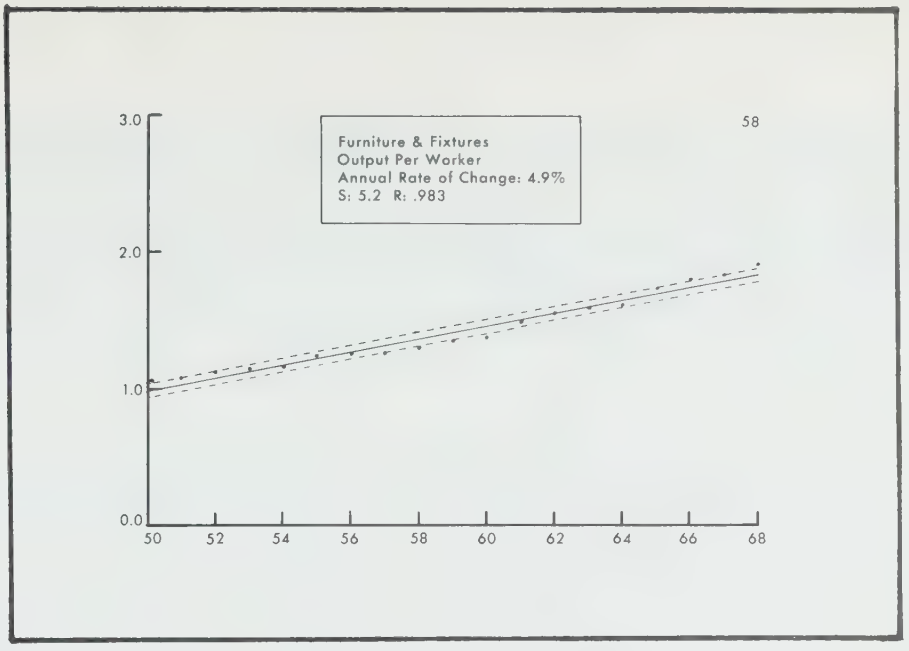
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			286.1			166.8			
Index of value added (1949 or 1961 = 100)			386.1			188.4		187.8	
Index of employment (1949 or 1961 = 100)	144.7	149.1		131.3	129.4				
Index of compensation per worker (1949 or 1961 = 100)	242.8	242.1		141.7	140.0				
Annual trend rate, compensation per worker	+6.7%	+6.7%		+5.8%	+5.7%				
Implicit, value-added price – index, 1949 or 1961 = 100			134.9			113.0		112.5	
– Annual trend rate of change			+1.5%			+2.2%		+2.2%	
– R value			.955			.955		.956	
Output per worker – index, 1949 or 1961 = 100	197.7	191.9		127.0	128.9				
– Annual trend rate of change	+5.0%	+4.9%		+3.8%	+4.2%				
– R value	.990	.983		.988	.988				
Unit labour cost – index, 1949 ot 1961 = 100	122.8	126.2		111.6	108.7				
– Annual trend rate of change	+0.9%	+0.9%		+1.6%	+1.1%				
– R value	.855	.817		.934	.752				
Unit residual cost – index, 1949 or 1961 = 100	146.7	149.7		114.1	119.6		118.3		
– Annual trend rate of change	+2.2%	+2.7%		+2.6%	+3.9%		+3.6%		
– R value	.964	.944		.951	.937		.947		
Payroll as a proportion of value added 1949	49.1%	62.6%							
1961				45.2%	60.9%		58.9%		
1968	44.7%	58.6%					56.9%		
Trend rate of change in labour share	–0.5%	–0.5%		–0.5%	–0.9%		–0.9%		
– R value	.882	.787		.863	.798		.786		
Trend rate of change in residual share	+0.5%	+0.8%		+0.5%	+1.6%		+1.3%		

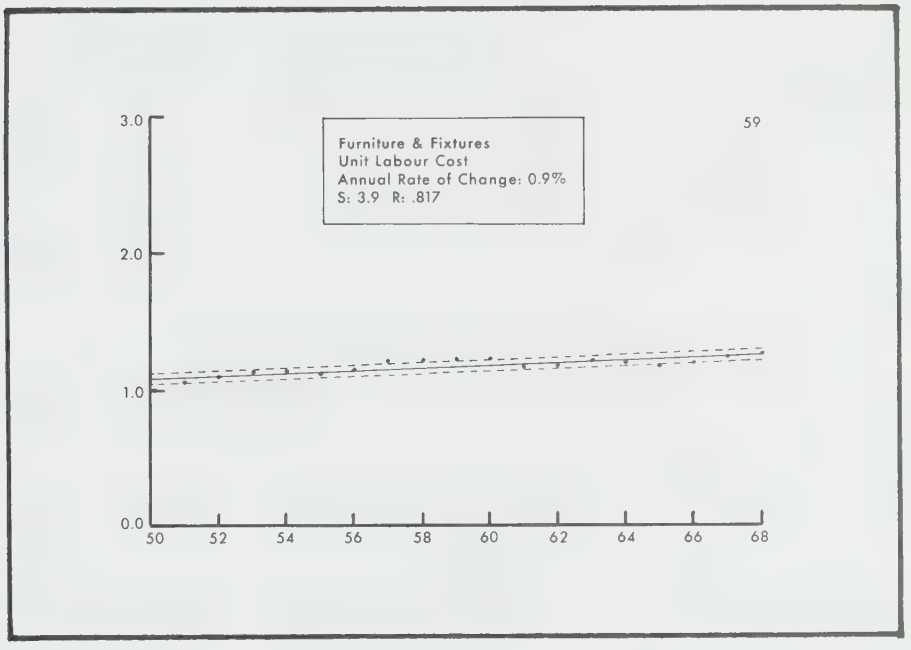
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

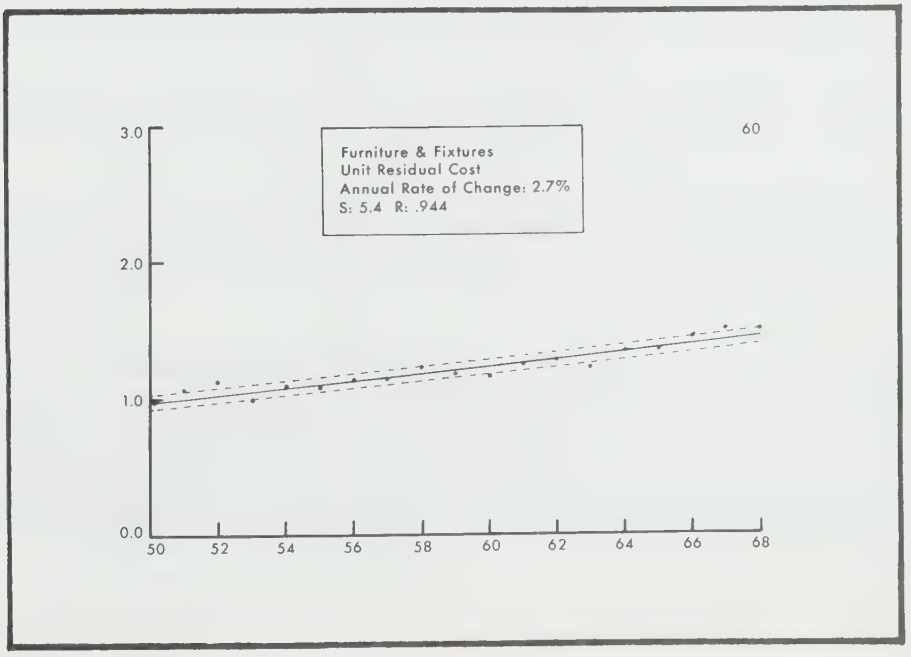

55
Furniture & Fixtures
Output per Worker
Annual Rate of Change: 5.0%
S: 4.1 R: .990
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


56
Furniture & Fixtures
Unit Labour Cost
Annual Rate of Change: 0.9%
S: 3.1 R: .855
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


57
Furniture & Fixtures
Unit Residual Cost
Annual Rate of Change: 2.2%
S: 3.6 R: .964
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


58
Furniture & Fixtures
Output Per Worker
Annual Rate of Change: 4.9%
S: 5.2 R: .983
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


59
Furniture & Fixtures
Unit Labour Cost
Annual Rate of Change: 0.9%
S: 3.9 R: .817
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


60
Furniture & Fixtures
Unit Residual Cost
Annual Rate of Change: 2.7%
S: 5.4 R: .944
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

percent, or five percent less than the 43.9 percent for all manufacturing (see Table 9A). The annual trend rate of increase for the full period, at 6.7 percent, was seven percent below the 7.2 percent for all manufacturing, and for the short period, at 5.8 percent, was eight percent below the 6.3 percent for all manufacturing.

For total labour the full-period and short-period increases in compensation (i.e. annual wages and salaries) were almost identical with those for production labour only. The full-period increase was 142.1 percent, or 15 percent less than the 166.5 percent increase in all manufacturing, and the short-period increase of 40.0 percent was 13 percent less than the 45.9 percent increase in all manufacturing (see Table 9B). The full-period annual trend rate of increase, at 6.7 percent (the same as for production labour), was 11 percent below the 7.5 percent for all manufacturing. The short-period rate of 5.7 percent (very slightly less than the 5.8 percent for production labour only) was not quite ten percent below the rate of 6.3 percent for all manufacturing.

For production labour annual wages per worker, average hourly earnings, and occupational (hourly) wage rates all increased by about the same amount both over the full and short periods. The increases between 1949 and 1968 were 142.8, 138.3 and 137.9 percent, and between 1961 and 1968 they were 41.7, 40.4 and 43.1 percent (see Table 9A).

Implicit (value-added) price increased by more than average over both the full and short periods. While the difference between 1949 and 1968 was 34.9 percent, or close to the difference of 33.0 percent for all manufacturing (see Table 12), the annual trend rate of increase, at 1.5 percent, was 50 percent greater than the comparable rate of 1.0 percent for all manufacturing. Between 1961 and 1968 there was an increase of 13.0 percent in this industry, or twice the increase of 6.2 percent for all manufacturing, while the annual trend rate of increase of 2.2 percent was almost 1 1/2 times the rate for all manufacturing. While the same rate of 2.2 percent also applied relative to value added by total activity, it was only about one-third greater than the 1.7 percent for all manufacturing. While the increases for this industry are above average, many of the industries studied had larger increases; over the full period, six industries had greater annual trend rates of increase, there were nine such industries over the short period with respect to value added by manufacturing and by total activity, and with respect to the latter, there was one other industry with the same rate of increase (see Table 16).

Between 1961 and 1968 while the implicit price indexes increased 13.0 and 12.5 percent with respect to value added by manufacturing and by total activity respectively, the industry selling price index increased by a similar 12.2 percent. The consumer (retail) price index for furniture increased over the same period by 20.3 percent but such an increase cannot be compared with the implicit (value-added) price changes, mentioned above, which apply to many industries in addition to the manufacture of household furniture.

While increases in output per worker were less than average over the full period and greater than average over the short period, like almost everything about this industry, they were not exceptionally so. The increase in output per production worker between 1949 and 1968 of 97.7 percent was 13 percent less than the increase of 112.7 percent for all manufacturing (see Table 17). The annual trend rate of increase, at 5.0 percent, was 15 percent less than the rate of 5.9 percent for all manufacturing. Between 1961 and 1968 there was an increase of 27.0 percent, 22 percent less than the increase of 34.6 percent for all manufacturing; however, the annual trend rate of increase, at 3.8 percent, was slightly greater than the 3.7 percent for all manufacturing. (The fact that the year-to-year increases from 1961 to 1964 followed almost exactly the long-term trend - see chart - while the increases from 1965 to 1968 all exceeded that trend explain the higher trend rate than is suggested by the difference between 1961 and 1968.) Over the full period 16 of the industries covered by this study had larger annual rates of increase, while over the short period the number of such industries was nine.

Output per worker with respect to total labour increased 91.9 percent between 1949 and 1968, about 11 percent less than the 103.7 percent increase for all manufacturing. The annual trend rate of increase was 4.9 percent, almost 15 percent below the all manufacturing rate of 5.8 percent. Between 1961 and 1968 the increase was 28.9 percent, about 20 percent greater than the increase of 24.1 percent for all manufacturing. The annual trend rate of increase was 4.2 percent, or about eight percent greater than the rate for all manufacturing. Over the full period 14 industries had greater rates of increase, while over the short period the number of such industries was nine.

The rates of increase in labour productivity were smaller for the short period than for the full period, which was so in most of the industries studied. However, in the short period they were higher than the rates for all manufacturing, while they were lower over the full period, indicating greater stability in growth of labour productivity in this industry. It should also be pointed out that while the rate of increase was slightly less over the full period for total than for production labour, over the short period, it was somewhat greater than that for production labour only.

Unit labour cost often follows the reverse pattern of output per worker, which is to be expected since the less labour productivity increases the more unit labour cost must increase, assuming the same rate of change in compensation per worker in either case. In this industry output per worker increased somewhat less than average over the full period and unit labour cost rather more than average; over the short period output per worker increased rather more than average and unit labour cost rather less than average.

With respect to production labour unit labour cost increased 22.8 percent between 1949 and 1968, virtually identical with the 23.0 percent increase for all manufacturing. The annual trend rate of increase was, however, at 0.9 percent, almost double the rate of 0.5 for all manufacturing. The trend rate is higher than the 1949-1968 difference would suggest because of more substantial increases in the 1950's (contributing to the high rate) followed by some years of slower change and larger increases once more in the last four years (see chart and Table 24). Between 1961 and 1968 the increase was 11.6 percent, more than two-thirds greater than the increase of 6.9 percent for all manufacturing. The annual trend rate of increase was 1.6 percent, almost double the full-period rate, but 20 percent less than the rate for all manufacturing. Unit labour cost increased more for most manufacturing industries in the short period but the increase was not as marked in furniture and fixtures.

Unit cost with respect to total labour increased 26.2 percent between 1949 and 1968, about 15 percent less than the 30.8 percent for all manufacturing. The annual trend rate of increase, at 0.9 percent (the same as for production labour), was about one-third greater than the rate of 0.7 percent for all manufacturing. The trend rate is much less than would be expected from the 1949-1968 difference and this is because of a rather steady rise from 1950 to 1960, followed by a marked drop in 1961 and little net change until 1966, followed by sizeable increases in 1967 and 1968 (see chart and Table 24). Between 1961 and 1968 there was an increase of 8.7 percent, only half of the increase of 17.6 percent for all manufacturing, and the annual trend rate of increase of 1.1 percent was just a little more than one-half the rate of 1.9 percent for all manufacturing.

With respect to production labour, five industries showed greater full-period rates of increase in unit labour cost and two had the same rate of increase as furniture and fixtures; for the short period ten industries had larger increases and one had the same rate. For total labour over the full period there were seven such industries and 15 over the short period.

Unit residual cost increases were larger than unit labour cost over both periods and with respect to both categories of labour. The increase between 1949 and 1968 with respect to production labour was 46.7 percent, 20 percent greater than the increase of 38.9 percent in all manufacturing, while the annual trend rate of increase of 2.2 percent was almost 70 percent greater than the 1.3 percent for all manufacturing. The trend rate is much greater than would be suggested by the 1949-1968 percentage increase because of fluctuations in the year-to-year changes (see the chart and Table 28). Between 1961 and 1968 the increase was 14.1 percent, which was 2 1/2 times greater than the increase of 5.8 percent in all manufacturing, while the annual trend rate of increase, at 2.6 percent, was almost 20 percent greater than the rate for the full period and compares with a situation of no net change in all manufacturing.

Related to total labour, unit residual cost increased only slightly more between 1949 and 1968 than the increase related to production labour only, 49.7 percent compared with 46.7 percent, but 40 percent more than the increase of 35.1 percent for all manufacturing. The annual trend rate of increase, at 2.7 percent, was 2 1/4 times greater than the rate of 1.2 percent for all manufacturing. Between 1961 and 1968 there was an increase of 19.6 percent, compared with a reduction of 1.2 percent for all manufacturing, and the annual trend rate of increase was 3.9 percent while in all manufacturing there was no net change over the period. Also with respect to total labour, but based on value added by total activity rather than by manufacturing activity, there was an increase of 18.3 percent between 1961 and 1968, compared with 5.0 percent for all manufacturing, and a slightly lower annual trend rate of increase of 3.6 percent, compared, however, with a rate of increase for all manufacturing of 1.6 percent rather than one of no net change, as noted above.

Over the full period the rates of increase in unit residual cost were quite high compared with most industries. Relative to production labour and over the full period, only three industries had greater rates and one had the same, while in relation to total labour and also over the full period, there were only two such industries. Over the short period the increases were not so high relatively (even though they were higher, absolutely); with respect to production labour, nine industries had higher rates, and there were six such industries in the case of total labour and value added by manufacturing and seven industries in the case of total labour and value added by total activity (see Table 31).

The labour share of value added declined over both the full and short periods for both production and for total labour. The production labour share dropped from 49.1 percent in 1949 to 45.2 percent in 1961 and to 44.7 percent in 1968, a total drop of 4.4 percentage points, or 9.0 percent. The total labour share moved down from 62.6 percent in 1949 to 60.9 percent in 1961 to 58.6 percent in 1968, a reduction of 4.0 percentage points or 6.4 percent. The total labour share related to value added by total rather than manufacturing activity moved down from 58.9 percent in 1961 to 56.9 percent in 1968. For both production and total labour, the annual trend rate of decrease was the same for the full period, at -0.5 percent, which was also the rate for production labour over the short period while the total labour share (related to both kinds of value added) decreased more quickly at -0.9 percent.

Furniture and fixtures was one of the more labour intensive industries among those studied. The 1949 production labour share of 49.1 percent was one-third higher than the 36.8 percent for all manufacturing and only two of the industries studied had larger shares; the 1949 total labour share, at 62.6 percent, was highest of all and almost one-third higher than the 48.6 percent for all manufacturing. The 1961 share for production labour, at 45.2 percent, continued to be one-third higher than the share in that year for all manufacturing of 33.8 percent, but six industries now showed larger shares compared with two previously. The 1961 share for total labour relative to value added by manufacturing, at 60.9 percent, was two-fifths greater than the 43.2 percent for all manufacturing, while the share relative to value added by total activity, at 58.9 percent, was

one-third greater than the 44.3 percent for all manufacturing. Five industries in each case showed larger total labour shares in 1961.

The composition of implicit (value-added) price for the furniture and fixtures industries is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.9	x	.491)	+	(2.2	x	.509)	=	1.6	1.5
Tot. lab., 1949-68[x]	(0.9	x	.626)	+	(2.7	x	.374)	=	1.6	1.5
Prod. lab., 1961-68[x]	(1.6	x	.452)	+	(2.6	x	.548)	=	2.1	2.2
Tot. lab., 1961-68[x]	(1.1	x	.609)	+	(3.9	x	.391)	=	2.2	2.2
Tot. lab., 1961-68[y]	(1.1	x	.589)	+	(3.6	x	.411)	=	2.1	2.2

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

Clearly, the major part of the increase was in every case unit residual cost. In the first equation unit residual cost is 70 percent of the implicit price change (the product of 2.2 x .509 as a percentage of 1.6), and the percentages for the following four equations are 63, 68, 69 and 70.

Saw and planing mills

Export trade has been of great importance in this industry and imports are not insignificant. This is indicated by estimates made for 1965 (see Table 1); exports accounted for 50.1 percent of the value of the industry's production and imports accounted for 10.1 percent of the value of total market sales of the products of the industry. Little of the industry's output is supplied directly to the consumer but the industry is, of course, an important source of raw materials to the construction industry, especially residential construction, and to furniture manufacturers, among others.

Saw and planing mills consist of sawmills (Standard Industrial Classification code 251) covering sawing of rough lumber, spool wood, lath and other mill products such as shingles, including mills that dress rough lumber on the sawmill premises but excluding pulpwood barking mills that are included in pulp and paper mills; also included are sash and door and planing mills (S.I.C. code 254) which are establishments primarily engaged in manufacturing dressed lumber, sash, door and window frames, interior woodwork, moulding and hardwood flooring as well as the manufacture of precut or prefabricated wooden buildings or panels for buildings and the manufacture of laminated rafters, roof trusses and beams. Establishments primarily engaged in producing plywood or veneer are classified under veneer and plywood mills (S.I.C. code 252) that are not included in this study because of problems of continuity in statistical data if they were included.

While introduction of the revised S.I.C. in 1960 meant some reorganization of the components of the industries comprising this group, continuity of data has been made possible by the adjustments described in Appendix A.

One of the first observations that must be made about this industry is that, except for output per worker, there are no linear trends over the full period. The computed linear trend rates for implicit (value-added) price, unit labour cost and unit residual cost are not statistically significant. However, for the more recent 1961-1968 period the trend rates are significant. Some nonlinear trends have been computed, which are discussed where appropriate.

Production increased less than average over both the full and short periods, by 106.5 percent between 1949 and 1968, 38 percent less than the 170.6 percent increase for all manufacturing, and between 1961 and 1968 by 45.2 percent, 26 percent less than the 61.1 percent for all manufacturing (see Table 2). Value added increased less than average over the full period and more than average over the short period. From 1949 to 1968 the increase was 200.2 percent, 23 percent less than the 259.9 percent increase for all manufacturing, while the increase between 1961 and 1968 was 111.4 percent, 37 percent more than the 71.0 percent for all manufacturing. Value added by total activity increased 103.8 percent, or 33 percent more than the 78.1 percent for all manufacturing.

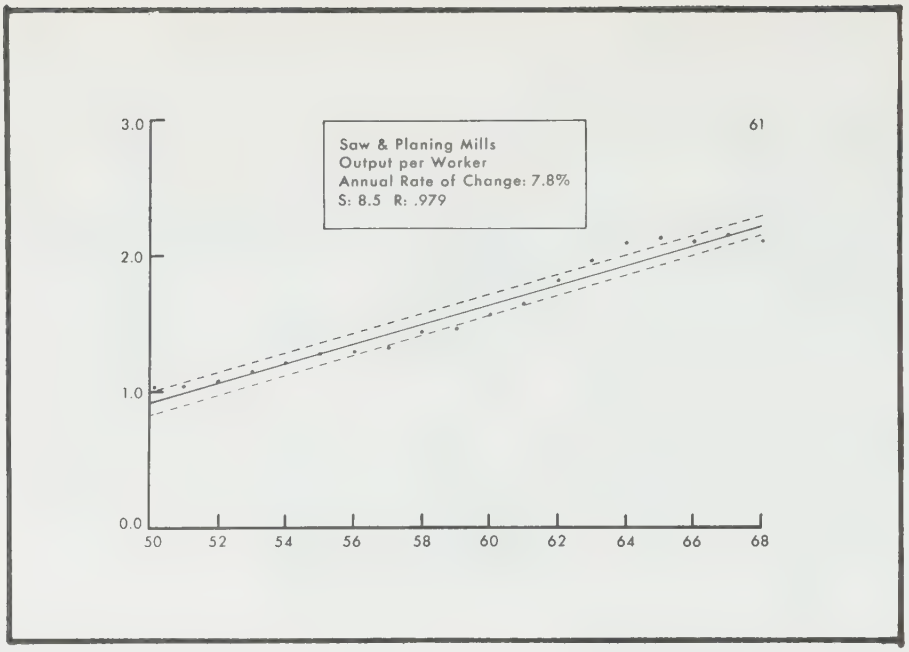
Employment of both production and total labour was less in 1968 than in 1949, only 1.6 percent less for production labour but 9.1 percent less for total labour, compared with 27.2 and 32.8 percent increases in all manufacturing (see Table 3). However, over the more recent (1961-1968) period employment increased, moving up by 13.4 percent for production labour, which was still 32 percent below the 19.7 percent in all manufacturing, and increasing 6.3 percent for total labour, which was 79 percent less than the rise of 29.8 percent in all manufacturing.

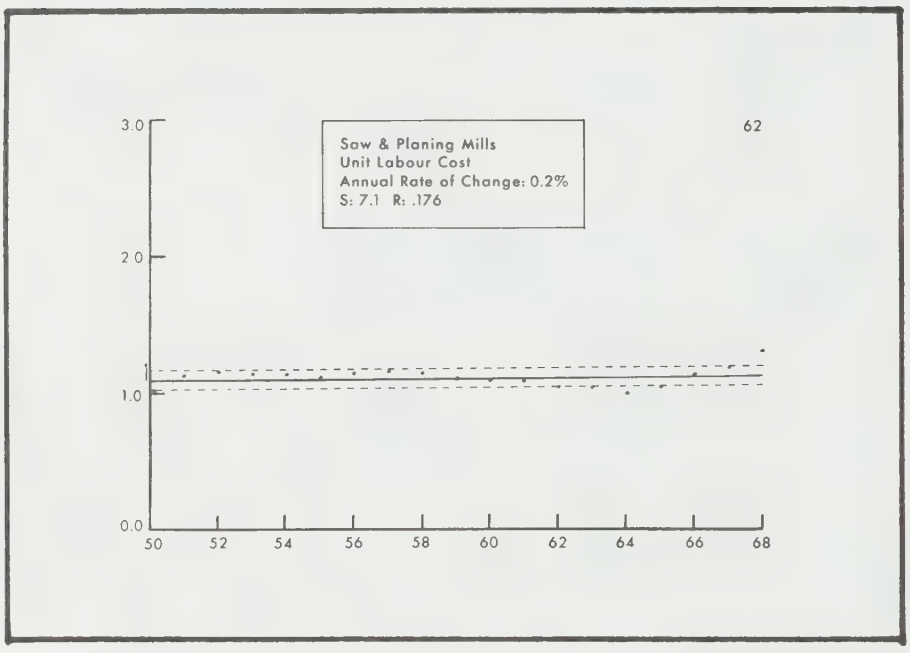
SAW AND PLANING MILLS

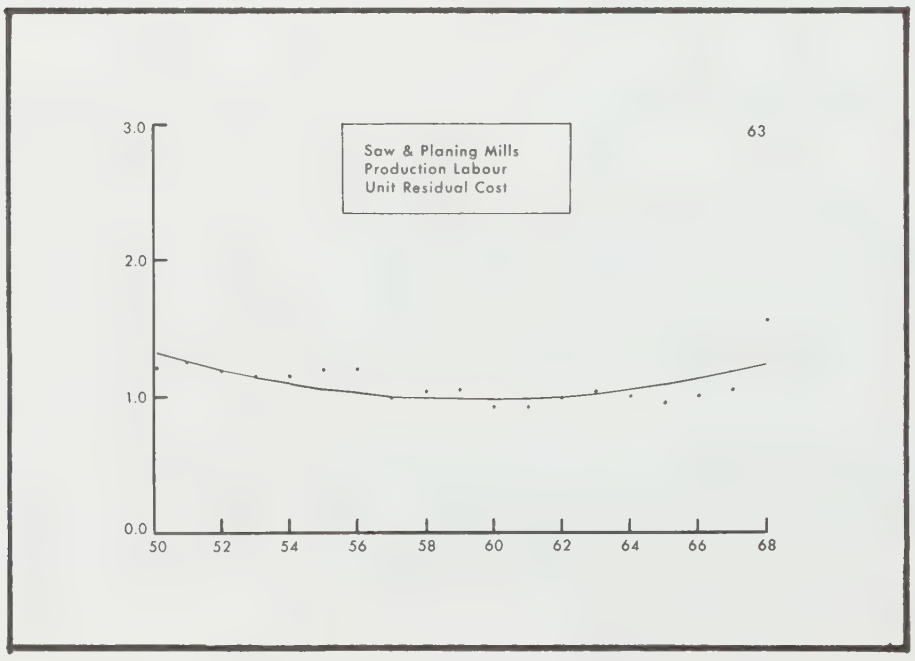
Summary Table — Principal Statistics

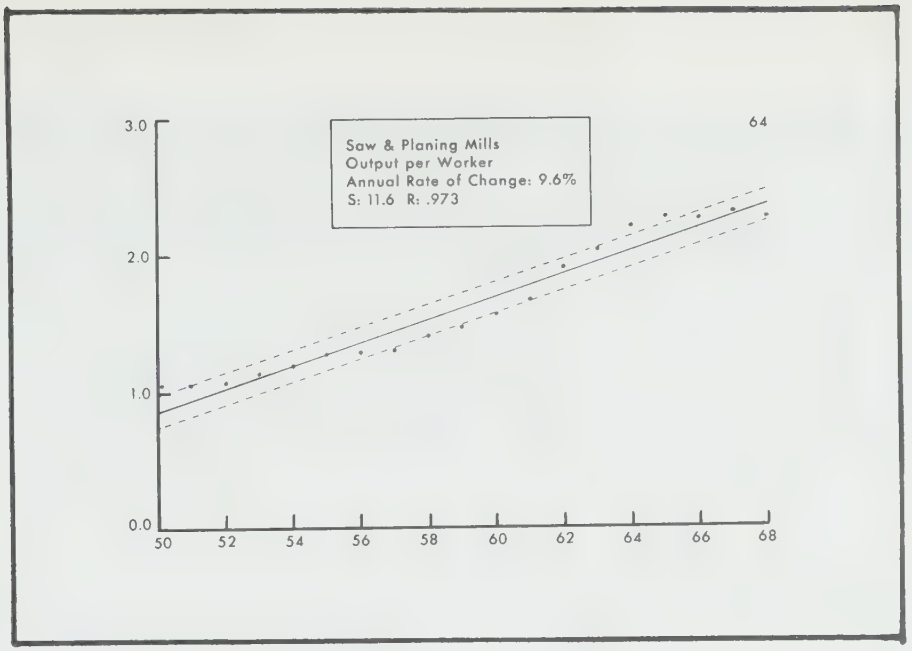
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			206.5			145.2			
Index of value added (1949 or 1961 = 100)			300.2			211.4		203.8	
Index of employment (1949 or 1961 = 100)	98.4	90.9		113.4	106.3				
Index of compensation per worker (1949 or 1961 = 100)	275.8	292.4		154.2	155.0				
Annual trend rate, compensation per worker	+8.5%	+9.6%		+7.5%	+7.8%				
Implicit, value-added price — index, 1949 or 1961 = 100			145.3			145.6		140.3	
— Annual trend rate of change			−0.2%			+5.8%		+5.3%	
— R value			.093			.724		.725	
Output per worker — index, 1949 or 1961 = 100	209.8	227.1		128.2	136.6				
— Annual trend rate of change	+7.8%	+9.6%		+2.2%	+3.0%				
— R Value	.978	.973		.814	.863				
Unit labour cost — index, 1949 or 1961 = 100	131.5	128 7		120.3	113.5				
— Annual trend rate of change	+0.2%	−0.0%		+4.5%	+4.0%				
— R value	.176	.021		.871	.827				
Unit residual cost — index, 1949 or 1961 = 100	156.8	165.2		170.1	197.1		186.4		
— Annual trend rate of change	−0.4%	−0.4%		+6.7%	+7.6%		+7.2%		
— R value	.187	.107		.638	.654		.631		
Payroll as a proportion of value added 1949	45.1%	54.3%							
1961				49.3%	61.7%		63.2%		
1968	40.8%	48.1%					51.1%		
Trend rate of change in labour share	+0.4%	+0.2%		−0.6%	−1.0%		−0.8%		
— R value	.384	.153		.211	.399		.341		
Trend rate of change in residual share	−0.3%	−0.2%		+0.4%	+1.0%		+1.1%		

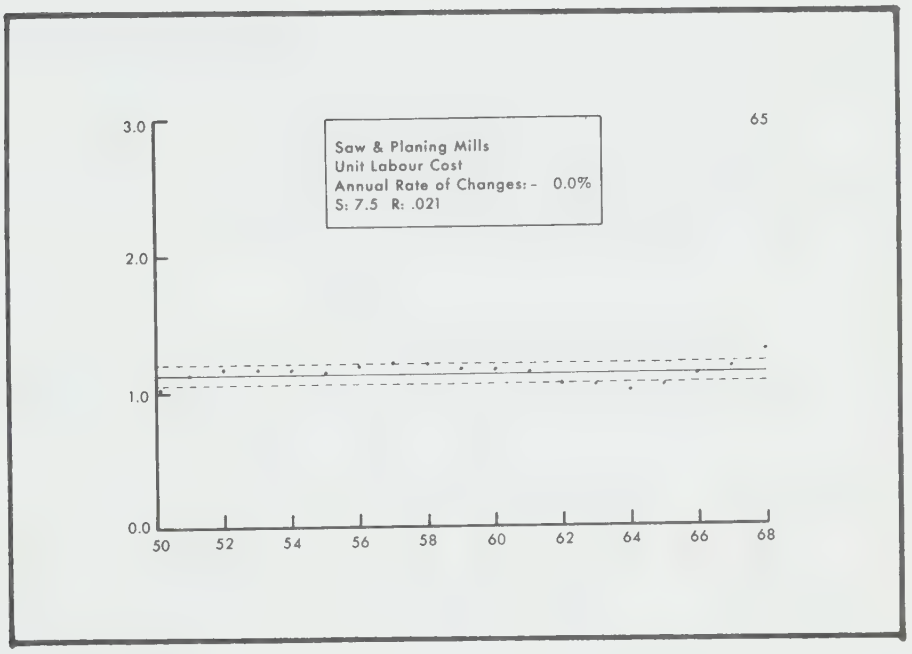
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

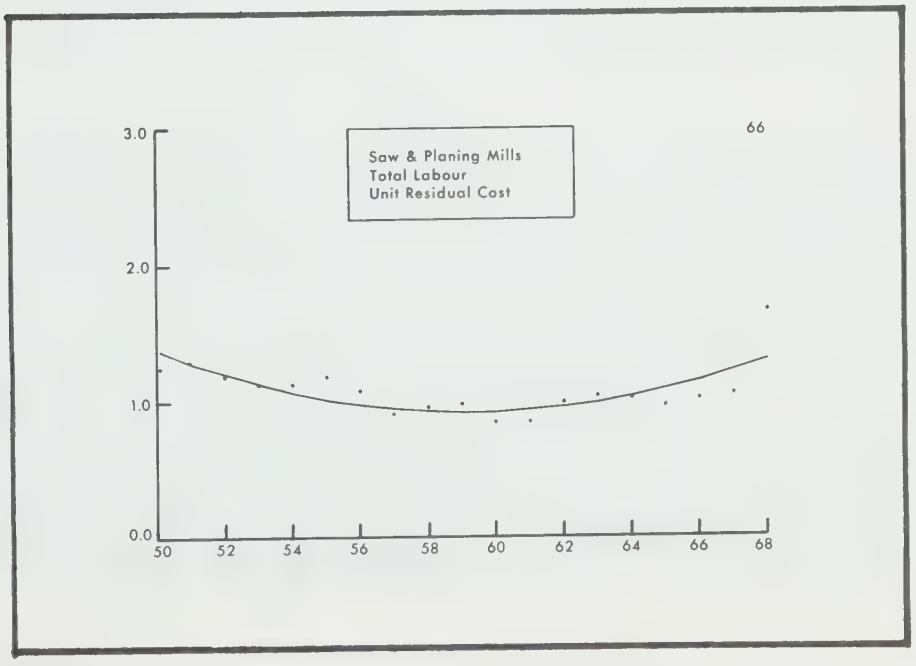

61
Saw & Planing Mills
Output per Worker
Annual Rate of Change: 7.8%
S: 8.5 R: .979
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


62
Saw & Planing Mills
Unit Labour Cost
Annual Rate of Change: 0.2%
S: 7.1 R: .176
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


63
Saw & Planing Mills
Production Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


64
Saw & Planing Mills
Output per Worker
Annual Rate of Change: 9.6%
S: 11.6 R: .973
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


65
Saw & Planing Mills
Unit Labour Cost
Annual Rate of Changes: - 0.0%
S: 7.5 R: .021
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


66
Saw & Planing Mills
Total Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

This is one of the few industries among those studied where the proportion of production labour to total labour employment increased between 1949 and 1968. The 1968 proportion was 86.8 percent, 8.2 percent greater than the 80.2 percent in 1949. The increase, at an annual rate of 0.5 percent, followed a steady, statistically significant trend (R = .83; see Table 5). This is one of four industries showing an increasing production labour proportion although in two of the other industries the trend was of dubious statistical significance. The production labour proportion in 1968, at 86.8 percent, was 11.7 percent above the 77.7 percent for all manufacturing and only two industries showed larger proportions.

Compensation (annual wages, annual wages and salaries) per worker increased more than average in saw and planing mills. Between 1949 and 1968 annual wages per production worker rose 175.8 percent, nine percent more than the 161.5 percent in all manufacturing (see Table 9A), with the annual trend rate of increase of 8.5 percent, some 18 percent greater than the 7.2 percent in all manufacturing. Between 1961 and 1968 the increase for production labour was 54.2 percent which was 23 percent more than the 43.9 percent in all manufacturing, with the annual trend rate of increase of 7.5 percent exceeding the 6.3 percent rate in all manufacturing to about the same extent as over the full period, by 19 percent, compared with 18 percent.

For total labour annual wages and salaries per worker were 192.4 percent greater in 1968 than 1949, exceeding the 166.5 percent in all manufacturing by about 16 percent. The annual trend rate of increase was 9.6 percent, 28 percent greater than the 7.5 percent in all manufacturing. Between 1961 and 1968 the increase was 55.0 percent, some 20 percent greater than the increase of 45.9 percent in all manufacturing, while the annual trend rate of increase at 7.8 percent exceeded the 6.3 percent in all manufacturing by 24 percent.

These rates of increase in compensation per worker are among the highest for the industries studied. Four industries had higher rates of increase for production labour over the full period, there were only two such industries with respect to total labour; for the short period there was only one such industry in each instance, (see Table 11).

In the case of production labour the increase between 1949 and 1968 of almost 175.8 percent was just about matched by the increase of 171.8 percent in average hourly earnings but occupational wage rates increased somewhat less, at 153.7 percent. However, between 1961 and 1968 occupational wage rates increased 49.9 percent, not far behind the 54.2 percent in annual wages per worker, while average hourly earnings increased the least, at 43.4 percent (see Table 9A). The reasons for differences in these measures of labour compensation are explained in general terms in Chapter Six.

Implicit (value-added) price was 45.3 percent higher in 1968 than in 1949 and 45.6 percent higher than in 1961, suggesting that all of the increase took place between 1961 and 1968. This is indicated by the annual trend rate of increase of 5.8 percent for the 1961-1968 period and a situation of no net change for 1949-1968, demonstrated by the fact that the trend rate computed for the full period is not statistically significant; the R value is only .093; but the R value for the 1961-1968 trend at .724 is significant. (For a discussion of tests of significance, see Appendix C.)

Analysis of the indexes in Table 12 reveals the erratic nature of implicit price movements in this industry. In 1955 implicit price was 15.7 percent higher than in 1949 and by 1961 was down to a little less than the 1949 value; in 1965 the index had the same value as in 1961, but in the following three years it increased 45.6 percent, most of the increase occurring between 1967 and 1968. Even in the 1949-1961 period it was not a case of a steady rise to a peak in 1955 and an equally steady decline through to 1961, which might suggest some kind of cycle; instead there were increases in 1950 and 1951, decreases in the next three years, then an increase to the 1955 peak, decreases the next two years, followed by an increase and then three decreases to 1961. Obviously there was no trend over those years. While an upward trend between 1961 and 1968 is visible from Table 12 and attested to by the significant R value, the trend is weakened by the downward break in 1964 and 1965. Our analysis of price change must concentrate on the 1961-1968 period aside from making the observation that between 1949 and 1961 there was no net change.

The implicit price change of 45.6 percent between 1961 and 1968 was more than seven times the increase of 6.2 percent for all manufacturing and was the largest increase over the time period for any of the industries studied. Considering the erratic nature of implicit price movements in this industry, it would be unwise to draw too much significance from this. If the increases were measured between 1961 and 1967, for example, a different picture would be drawn. Between 1961 and 1968 the industry selling price index for sawmills and planing mills increased 40.3 percent, somewhat less than the 45.6 percent for implicit (value-added) price; on the other hand, between 1961 and 1967 industry selling price rose 20.0 percent, or almost twice as much as the 10.6 percent rise in implicit price.

Notwithstanding the considerable variation from year to year in implicit price behaviour, we must not overlook the statistically significant annual trend rate of increase of 5.8 percent over the short period which is very much greater than the rate of increase of 0.9 percent for all manufacturing. It is, indeed, the highest rate for any of the industries studied (see Table 16). While the annual trend rate over the same period, relative to value added by total activity, at 5.3 percent, is not quite so much in excess of the average rate, which is 1.7 percent, it is still the highest rate shown.

Output per worker did exhibit a strong linear trend through the entire 1949-1968 period, in contrast with trends computed for the other measures. That the trends are strong and statistically significant is demonstrated by the high R values

relative to output per worker (production labour, total labour) of .978 and .973 for the full period and .814 and .863 for the short period.

Between 1949 and 1968 output per production worker increased 109.8 percent, slightly less than the 112.7 percent for all manufacturing (see Table 17). However, the annual trend rate of increase over the full period was 7.8 percent, one-third greater than the rate of 5.9 percent for all manufacturing. The apparent inconsistency between the modest increase, as measured by 1968 relative to 1949, and the more substantial trend rate of increase arises from the fact that the growth in productivity mostly took place between 1952 and 1958 (up 32.8 percent) and 1959 and 1964 (up 42.6 percent), while there was a net increase between 1964 and 1968 of only 0.9 percent (see chart and Table 17). Thus, for 1961-1968, virtually all of the increase took place in the first three years, which explains the even smaller increase over this period relative to all manufacturing than that obtained for the full period; over this short period the increase was 28.2 percent, almost 20 percent less than the increase of 34.6 percent for all manufacturing. It also explains why the annual trend rate of increase was much lower, at 2.2 percent, down from the 7.8 percent for the full period. While the full-period rate was above average, the short-period rate was 40 percent below the 3.7 percent for all manufacturing. However, the full-period rate was not exceptionally above average (ten industries had higher rates) nor the short-period rate exceptionally below average (five industries had lower rates; see Table 19).

For total labour, performance of output per worker was much the same as for production labour except that the increases were rather larger. This is principally because of a somewhat stronger and more consistent uptrend from 1956 through to 1965, (an increase of 77.4 percent; see chart and Table 17). Between 1949 and 1968 output per worker increased 127.1 percent, about 23 percent more than the 103.7 percent for all manufacturing. The annual trend rate of increase was 9.6 percent, compared with 7.8 percent for production labour, and almost two-thirds greater than the rate of 5.8 percent for all manufacturing (the margin was one-third for the production worker measure). There was an increase of 36.6 percent between 1961 and 1968, some 50 percent greater than the 24.1 percent for all manufacturing. The annual trend rate of increase for this short period was 3.0 percent, still somewhat higher than the rate for production labour only, but 23 percent less than the rate of 3.9 percent for all manufacturing (compared with a production labour rate of increase that was 40 percent less). As with production labour, the full-period rate was not exceptionally above average (six industries had higher rates) or the short-period rate exceptionally below average (nine industries had lower rates; see Table 19).

Care must be exercised in assessing the significance of labour productivity trends in this industry through 1961-1968. As pointed out already and as illustrated by the charts, there was a substantial rise in the early years, followed by a levelling off in the last four years. Such differences mean that short-term projections of labour productivity are likely to be unreliable.

The lack of any clear linear trend for both unit labour and unit residual cost over the full period makes analysis of the full period almost meaningless. (The reader can see on the summary table of statistics the low R values in these instances.) Nonlinear trends have been computed for both unit labour and unit residual cost that have a much better fit; they are shown in Appendix C and those for unit labour cost are depicted on charts accompanying this section. Significant linear trends have been discerned for the short period for both measures of unit cost; therefore, the following analysis concentrates on the short period.

Unit production labour cost increased 20.3 percent between 1961 and 1968, considerably more than the 6.9 percent increase for all manufacturing (see Table 24), and the annual trend rate of increase of 4.5 percent was 2 1/4 times the rate of 2.0 percent for all manufacturing. Only three of the industries studied had a higher rate of increase (see Table 26). For total labour the increase was 13.5 percent over this period, or 23 percent less than the 17.6 percent in all manufacturing. However, the annual trend rate of increase of 4.0 percent, while a little less than the 4.5 percent for production labour only, was still more than twice the rate of 1.9 percent for all manufacturing. As with production labour, only three industries had higher rates of increase.

While unit labour cost increased more than average over the recent 1961-1968 period, the rise in unit residual cost was even greater. With respect to both production and total labour, the annual trend rates of increase in this industry were higher than for any other industry studied (see Table 31). Between 1961 and 1968 the measure related to production labour rose 70.1 percent compared with only 5.8 percent for all manufacturing (see Table 28). The annual trend rate of increase of 6.7 percent compares with a situation of no net change in all manufacturing. The contrast with other industries is even more pronounced in the case of the measure related to total labour. In this industry there was an increase between 1961 and 1968 of 97.1 percent while for all manufacturing there was a reduction of 1.2 percent. The annual trend rate of 7.6 percent is higher than the 6.7 percent related to production labour only and is in contrast with an annual rate of decline of -0.1 percent for all manufacturing. Similar observations can be applied to the measure of unit residual cost increase relative to total labour and value added by total rather than manufacturing activity.

The lack of any trend upwards or downwards in the 1950's in unit labour and unit residual cost, a broken trend in the 1960's in unit labour cost (downward until 1964, then upward), and erratic movements in the 1960's in unit residual cost combined to produce no definite trend towards an increased or decreased labour share. This is demonstrated by the low R values for the annual trend rates of change (see summary table). The production labour share was 45.1 percent in 1949, 49.3

percent in 1961 and 40.8 percent in 1968; its lowest value was in fact in 1968, but the highest, at 49.4 percent, was in 1960. Indicative of the vagaries of the labour share is the fact that while it was at its lowest in 1968, two of the highest values were for the two immediately preceding years and there was a 16 percent drop between 1967 and 1968. The performance of the total labour share was similar (see Table 34), although a falling share seems to be evident in spite of the fluctuations.

While there is little evidence of any trend, it does not mean that the labour share remained constant; rather, it was unstable, shifting up and down. If the shares in this industry in 1949 for production and total labour are compared with those for the other industries studied, it appears to have been one of the more labour intensive industries, for production labour the share being exceeded in only three industries and the same in another, but relatively less intensive for total labour with seven industries having a larger share. The production labour share was, in 1949, about 23 percent larger than that in all manufacturing, the total labour share about 12 percent greater. However, because of the instability mentioned above, a comparison for other years might produce a different result.

Because of the absence of a statistically significant trend in implicit (value-added) price over the full period, its composition for saw and planing mills is given only for the 1961-1968 period, as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1961-68[x]	(4.5	x	.493)	+	(6.7	x	.507)	=	5.6	5.8
Tot. lab., 1961-68[x]	(4.0	x	.617)	+	(7.6	x	.383)	=	5.4	5.8
Tot. lab., 1961-68[y]	(4.0	x	.632)	+	(7.2	x	.378)	=	5.3	5.3

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

These equations understate somewhat the rate of change in implicit price because the values in column A, which are the results of the equations, are for the first two equations, less than those in columm B which are trend rates computed by least squares from the actual annual values. (This point is discussed further following the equations in the section dealing with slaughtering and meat processors.) Nevertheless, it is reasonable to conclude that unit residual cost is the major component of implicit price change in the first equation, constituting 61 percent; the factors are more evenly matched in the other two equations, unit residual cost accounting for 54 and 52 percent. Since nonproduction labour is part of unit residual cost relative to production labour, the conclusion is that when all labour is included in the one unit cost measure and all nonlabour in the other measure, the two have been about even as components of price change; this is because, while the residual weight is slightly less than 40 percent and the labour weight slightly more than 60 percent, unit residual cost was increasing twice as fast as unit labour cost.

Pulp and Paper mills

This has been and is one of the country's most important export industries, with exports accounting for 67.9 percent of industry output in 1965, according to estimates prepared for this study (see Table 1). The industry has not been faced with very much import competition except for certain special product lines, especially fine paper; in 1965 imports accounted for 8.7 percent of the value of total market sales, but the percentage may have increased in more recent years. Most of the output meant for domestic use is supplied to other industries for further processing, as in printing and publishing, or in the manufacture of paper boxes and bags (which are mostly supplied to other industries for use as containers of their output).

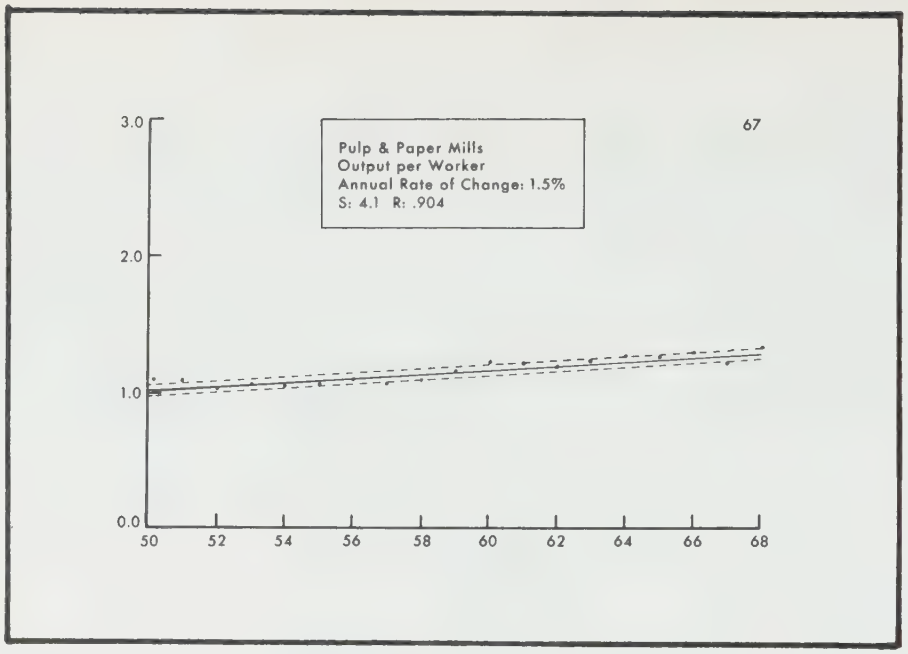
Pulp and paper mills (Standard Industrial Classification code 271) includes pulp mills producing chemical or mechanical wood pulp, combined pulp and paper mills and paper mills manufacturing newsprint, book and writing paper, kraft paper, paperboard and insulation board; also mills engaged in producing barked or rossed pulpwood; however, establishments engaged in manufacturing converted paper and paperboard products are classified elsewhere. The introduction of a new Standard Industrial Classification in 1960 did not cause any problems with continuity of data under the old and new classifications. Whatever adjustments were necessary for maintenance of continuity are described in Appendix A.

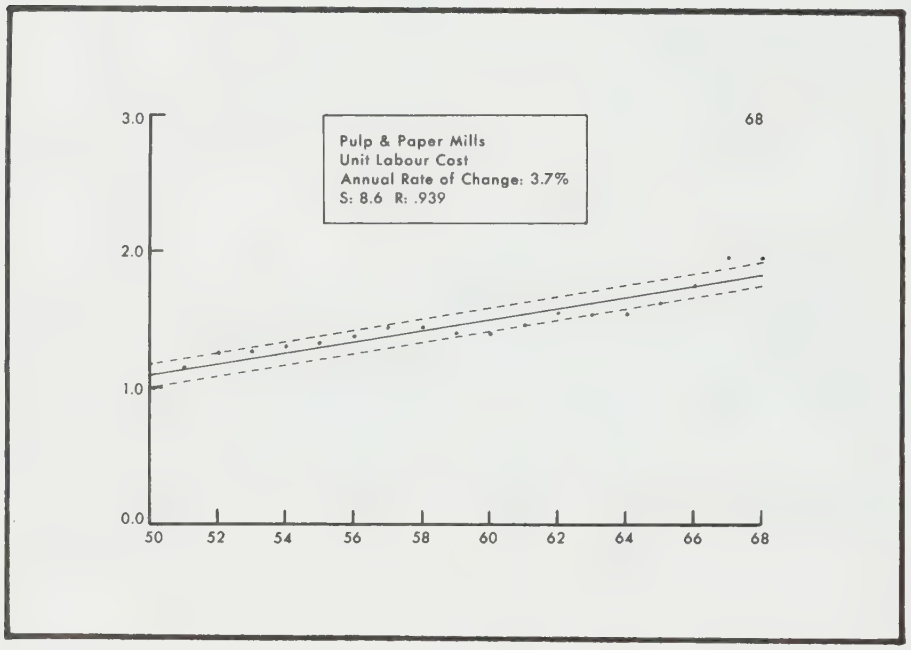
Increases in this industry in both production and value added were much below average. Production increased 78.9 percent between 1949 and 1968, 54 percent less than the 170.6 percent for all manufacturing, while the 20.5 percent increase between 1961 and 1968 was 66 percent less than the 61.1 percent for all manufacturing (see Table 2). Only four industries, among those studied, registered smaller increases over both the full and the short periods. Value added increased 154.8 percent over the full period, 40 percent less than the 259.9 percent increase for all manufacturing, while the increase was 28.6 percent over the short period, 60 percent less than the 71.0 percent for all manufacturing. Four industries had smaller increases over the full period and only two industries over the short period. The performance of value added by total activity over the short period was much the same as that of value added by manufacturing activity.

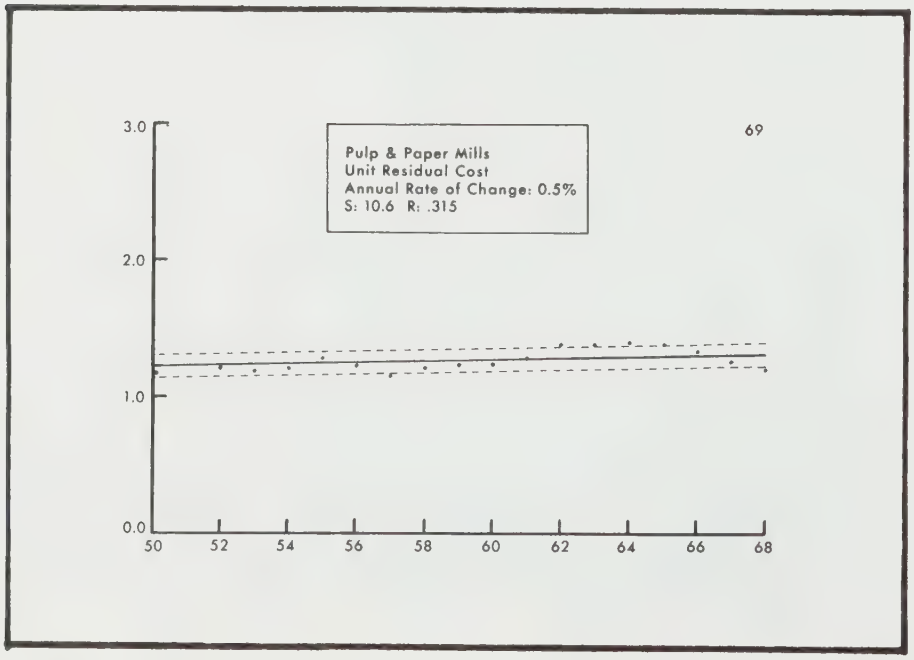
Summary Table — Principal Statistics

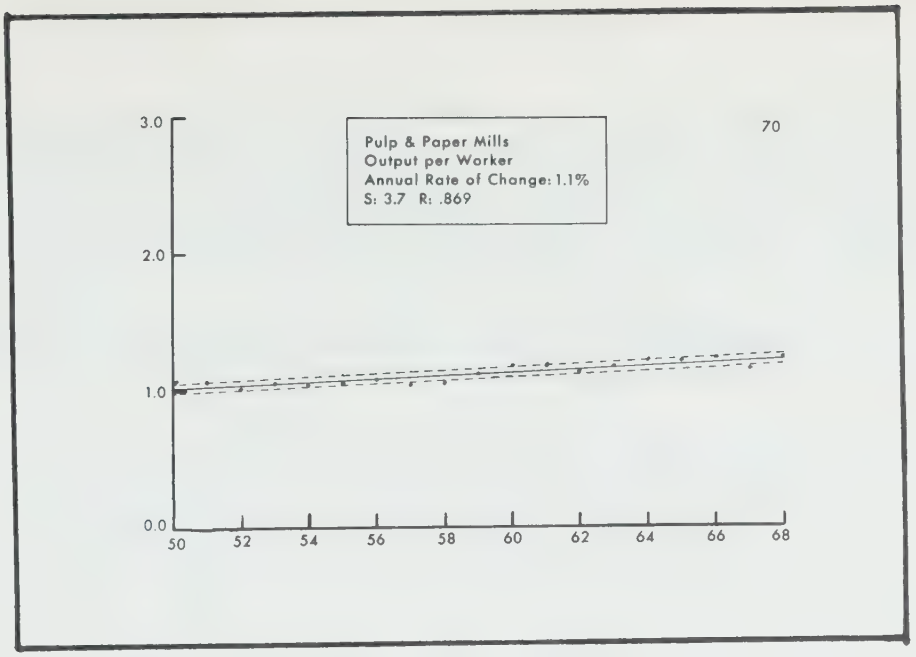
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			178.9			120.5			
Index of value added (1949 or 1961 = 100)			254 8			128.6		128.5	
Index of employment (1949 or 1961 = 100)	137.3	145.3		112.9	115.2				
Index of compensation per worker (1949 or 1961 = 100)	254.3	238 7		142.8	141.4				
Annual trend rate, compensation per worker	+6.5%	+5.4%		+6.7%	+6.6%				
Implicit, value-added price — index, 1949 or 1961 = 100			142.4			106.7		106.6	
— Annual trend rate of change			+1.3%			+0.2%		+0.2%	
— R value			.830			.324		.360	
Output per worker — index, 1949 or 1961 = 100	130.3	123.1		106.7	104.6				
— Annual trend rate of change	+1.5%	+1.1%		+0.9%	+0.8%				
— R value	.904	.869		.590	.497				
Unit labour cost — index, 1949 or 1961 = 100	195.2	193.9		133.8	135.2				
— Annual trend rate of change	+3.7%	+3.4%		+5.5%	+5.6%				
— R value	.939	.927		.923	.917				
Unit residual cost — index, 1949 or 1961 = 100	120.3	111.9		83.8	87.8		88.0		
— Annual trend rate of change	+0.5%	+0.2%		−1.7%	−2.6%		−2.9%		
— R value	.315	.122		.842	.854		.858		
Payroll as a proportion of value added 1949	29.5%	37.2%							
1961				32.3%	40.0%		39.6%		
1968	40.4%	50.7%					50.2%		
Trend rate of change in labour share	+1.7%	+1.8%		+5.3%	+5.3%		+5.4%		
— R value	.596	.750		.914	.902		.901		
Trend rate of change in residual share	−0.7%	−1.0%		−2.0%	−2.8%		−3.2%		

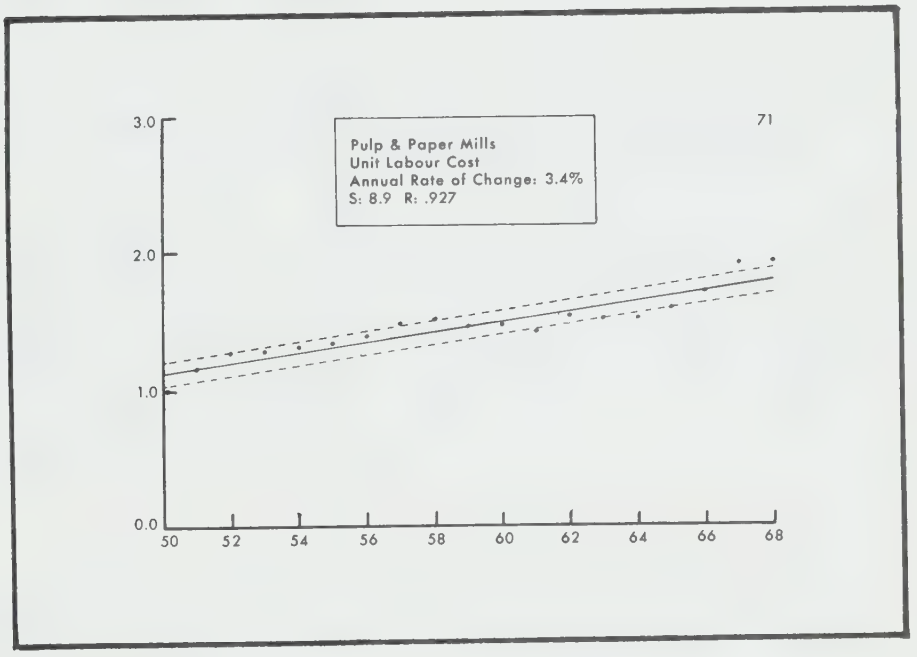
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

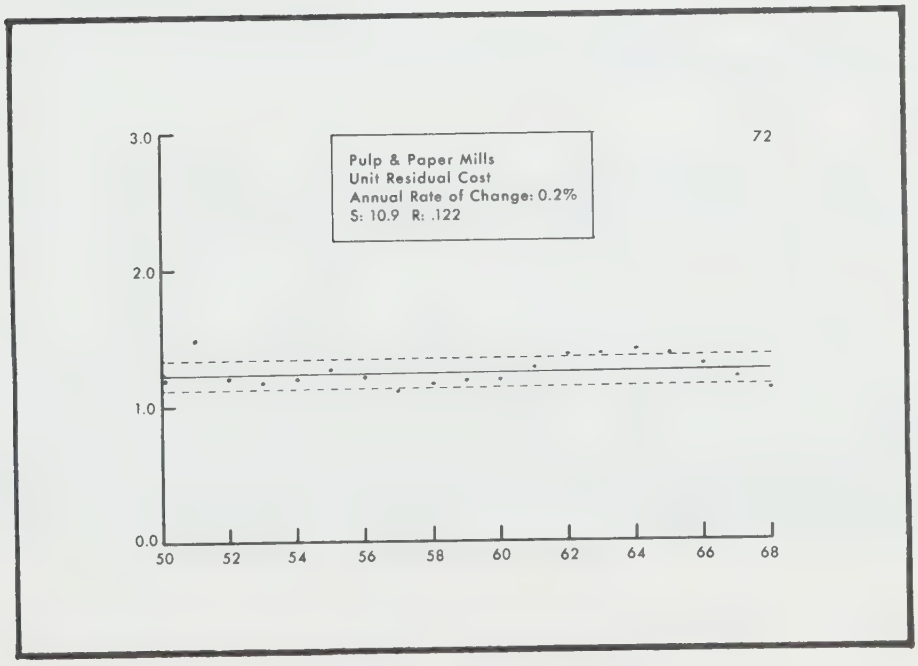

67
Pulp & Paper Mills
Output per Worker
Annual Rate of Change: 1.5%
S: 4.1 R: .904
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


68
Pulp & Paper Mills
Unit Labour Cost
Annual Rate of Change: 3.7%
S: 8.6 R: .939
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


69
Pulp & Paper Mills
Unit Residual Cost
Annual Rate of Change: 0.5%
S: 10.6 R: .315
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


70
Pulp & Paper Mills
Output per Worker
Annual Rate of Change: 1.1%
S: 3.7 R: .869
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


71
Pulp & Paper Mills
Unit Labour Cost
Annual Rate of Change: 3.4%
S: 8.9 R: .927
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


72
Pulp & Paper Mills
Unit Residual Cost
Annual Rate of Change: 0.2%
S: 10.9 R: .122
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Employment of both production and total labour increased somewhat more than average over the full period and less than average over the more recent, short period. Between 1949 and 1968 the employment of production labour went up 37.3 percent, which is 37 percent more than the all-manufacturing rise of 27.2 percent; over the same period total labour employment rose 45.3 percent, 38 percent more than the rise of 32.8 percent for all manufacturing (see Table 3). Over the more recent period (1961-1968) there was an increase of 12.9 percent in production labour employment, one-third less than the 19.7 percent in all manufacturing, and of 15.2 percent in total labour, slightly better than one-half the 29.8 percent in all manufacturing. Over the full period the production labour share of total employment dropped 5.6 percent, from 84.2 to 79.5 percent, with an annual trend rate of decrease of -0.3 percent, of high statistical significance (see Table 5). The proportion for production labour of 79.5 percent was slightly higher than the 77.7 percent in all manufacturing.

Compensation (annual wages, annual wages and salaries) per worker increased less than average over the full period and a little more than average over the short period. There was an increase of 154.3 percent in compensation per production worker between 1949 and 1968, 4.5 percent below the increase of 161.5 percent in all manufacturing (see Tables 9A, 9B). The annual trend rate of increase for production labour was 6.5 percent, about ten percent less than the rate of 7.2 percent for all manufacturing, while the rate for total labour was 5.4 percent, 28 percent less than the rate in all manufacturing.

Between 1961 and 1968 compensation per production worker increased 42.8 percent, or about as much as the 43.9 percent in all manufacturing, with the more substantial year-to-year increases from 1965 to 1968 bringing about an annual trend rate of increase of 6.7 percent, a little higher than the 6.3 percent in all manufacturing. Over the same period total labour compensation per worker moved up 41.4 percent, somewhat less than the 45.9 percent in all manufacturing, while the annual trend rate of increase was 6.6 percent, somewhat more than the 6.3 percent in all manufacturing.

Over the full period annual wages per worker increased less than average hourly earnings or occupational wage rates in the industry, the increases being respectively 154.3, 189.4 and 176.0 percent, but between 1961 and 1968 there was virtual uniformity, the increases being 42.8, 40.4 and 40.0 percent (see Table 9A). Reasons for differences in the increases in these different measures of production worker income are set forth in general terms in Chapter Six.

Implicit (value-added) price in this industry followed an erratic pattern marked by sudden increases and decreases and many years of little change. Between 1949 and 1951 there was a rise of 39.1 percent, followed by a reduction of 12.2 percent the next year and a change of only 5.7 percent over the years 1952 to 1960 inclusive, with a more substantial rise of 10.7 percent over the next two years, a rise of only 2.9 percent from 1962 to 1967, and a drop of 3.1 percent in the final year (see Table 12). The increases were large when they took place and spaced in such a way (1949-1951 and 1960-1962), with few reductions in the other years, that they produced a statistically significant annual trend rate of increase over the full period of 1.3 percent. However, the 42.4 percent difference between 1949 and 1968 suggests a greater annual rate of increase than actually occurred because of the behaviour described above. Furthermore, because there was virtually no change from 1962 to 1968, the annual trend rate of increase of 0.2 percent for the short period is of little statistical significance. The conclusion is that there was a significant upward trend in implicit price in the 1950's and virtual stability (that is, no net change) in the 1960's.

The increase in implicit (value-added) price between 1949 and 1968 of 42.4 percent was 28 percent greater than the 33.0 percent in all manufacturing (see Table 12), just as the annual trend rate of increase of 1.3 percent was 30 percent greater than the rate of 1.0 percent in all manufacturing. Eight of the industries studied had greater rates of increase over the full period (see Table 16). Because of the nature of the situation in the more recent period, a comparison of implicit price change with other industries must be made in a rather different way. At an annual trend rate of increase of 0.2 percent, implicit price (relative to value added, manufacturing and value added, total activity) in this industry was closer to no change than in any other industry studied; the jump between 1961 and 1962 (which actually started a year earlier but is not part of the time period under consideration) sufficiently affected the average fit of the actual to the trend values to produce a lower R value than for any other industry for the 1961-1968 period.

Between 1961 and 1968 there was an increase of 6.7 percent in implicit price relative to value added, manufacturing, and of 6.6 percent in implicit price relative to value added, total activity, chiefly because of the rise between 1961 and 1962. Over the same years the industry selling price index increased somewhat more, at 10.1 percent. The difference must be explained by rising costs of raw materials and other inputs or in wholesale costs not included in value added and thus not part of value-added price.

Labour productivity increased far less than average in this industry over both the full and short periods and with respect to both production and total labour. Between 1949 and 1968 the increase for production labour was 30.3 percent, 73 percent below the increase of 112.7 percent in all manufacturing (see Table 17); the annual trend rate of increase was 1.5 percent, 75 percent less than the rate of 5.9 percent in all manufacturing. Only one industry among those studied had a lower rate (see Table 19). For total labour the increase over the full period of 23.1 percent was 78 percent less than the increase of 103.7 percent in all manufacturing; the annual trend rate of increase was 1.1 percent, 81 percent less than the rate of 5.8 percent in all manufacturing. Only one of the industries in our study had a lower rate of increase.

Increases were no closer to the average in the short period. For production labour there was an increase of 6.7 percent, 81 percent less than the 34.6 percent in all manufacturing; the annual trend rate of increase of 0.9 percent was 76 percent below the average rate of 3.7 percent. Only one industry had a lower rate and two others had the same rate. For total labour the increase was 4.6 percent, 81 percent less than the 24.1 percent in all manufacturing; the annual trend rate of increase of 0.8 percent was 79 percent below the rate of 3.9 percent in all manufacturing. Only one industry had a lower rate and it was in fact a rate of decrease. Over both periods the increase in output per worker was somewhat less for total labour than it was for production labour only.

Just as output per worker increased much less than average, so - as might be expected - unit labour cost increased much more than average. Because of a general acceleration of unit labour cost in most manufacturing industries in the 1960's, this industry's margin over the average was less for the more recent period.

Between 1949 and 1968 unit labour cost for production workers increased 95.2 percent, or more than four times the increase of 23.0 percent in all manufacturing (see Table 24). The annual trend rate of increase of 3.7 percent was almost 7 1/2 times the rate of 0.5 percent in all manufacturing. Only one industry among those studied had a higher rate (see Table 26). For total labour over the full period the increase was 93.9 percent, more than three times the 30.8 percent in all manufacturing; the annual trend rate of increase was 3.4 percent, close to five times as much as the 0.7 percent in all manufacturing. Only one industry had a higher rate and one other had the same.

Between 1961 and 1968 unit labour cost for production labour rose 33.8 percent, almost five times the increase of 6.9 percent in all manufacturing; the annual trend rate of increase was 5.5 percent, 2 3/4 times the rate of 2.0 percent in all manufacturing. No other industry had as high a rate of increase. For total labour the increase between the two years was 35.2 percent, twice the increase of 17.6 percent in all manufacturing; the annual trend rate of increase was 5.6 percent, almost three times the rate of 1.9 percent in all manufacturing. Only one industry had a greater rate of increase (see Table 26).

The rates of increase were higher for the more recent period which, as mentioned above, was the general pattern, and they were not markedly different for production compared to total labour.

Unit residual cost followed an erratic path through the 1950's, reaching a peak in 1964, followed by a steady decline thereafter. This is clearly visible from the charts and can be followed in detail in Table 28. The result is trend rates for the full period that are statistically without significance and short-period rates that are significant. (It happens that a nonlinear function has been found that fits the movements over the full period much better and raises the R values from .315 and .122 to .629 and .621 respectively; see Appendix C). For this reason there is no point in comparing the full-period measures for this industry with those for other industries. It can be concluded that for the full period unit residual cost was a rather insignificant component of implicit (value-added) price change. Since this is not so for the short period, an analysis of this time period is in order.

Between 1961 and 1968 unit residual cost with respect to production labour in pulp and paper mills declined 6.2 percent, while there was an increase of 5.8 percent in all manufacturing (see Table 28); there was an annual trend rate of decline of -1.7 percent compared with no net change in all manufacturing. Only three industries showed greater rates of decline (see Table 31). With respect to total labour and value added by manufacturing, there was a decrease over these years of 12.2 percent, compared with a decrease of 1.2 percent in all manufacturing; the annual trend rate of decline was -2.6 percent, compared with no net change in all manufacturing. Two industries had greater negative rates and one had the same rate. With respect to total labour and value added, total activity, the reduction in unit residual cost was 12.0 percent compared with a 5.0 percent increase in all manufacturing; the annual trend rate of decline was -2.9 percent, compared with a rate of increase of 1.6 percent in all manufacturing. Only one industry had a greater rate of decline.

Inasmuch as unit labour cost consistently increased and unit residual cost either held steady or decreased, while implicit (value-added) price increased moderately in the 1950's and levelled off after 1962, it is to be expected that the labour share of value added would increase.

The production labour share moved up from 29.5 percent in 1949 to 32.3 percent in 1961 to 40.4 percent in 1968. This constituted an annual trend rate of increase of 1.7 percent for the full period and 5.3 percent for the short period. The rates compare with a rate of decrease of -0.4 percent over the full period and a rate of increase of 1.1 percent for the short period in all manufacturing. In no other industries were the rates of increase as high (see Table 36). The total labour share moved up from 37.2 percent in 1949 to 40.0 percent in 1961 to 50.7 percent in 1968, constituting annual trend rates of increase of 1.8 percent for the full period and 5.3 percent for the short period, compared with a rate of decrease of -0.2 percent and an increase of 1.0 percent for all manufacturing. Only one industry had a higher rate of increase for the full period and there were no such industries for the short period.

The industry moved from being somewhat less labour intensive than average in 1949 to more than average by 1968. While the industry's production labour share in 1949 of 29.5 percent was significantly less than the 36.8 percent for all manufacturing, the figure of 40.4 percent in 1968 was just as significantly greater than the 34.0 percent for all manufacturing. The total labour share for the industry was 37.2 percent in 1949 compared with 48.6 percent for all manufacturing and was

up to 50.7 percent in 1968, compared with 47.8 percent for all manufacturing. The 1968 margin over all manufacturing was not as great for total labour as for production labour. (This analysis has not included the total labour share of value added by total activity, but it is similar to that for total labour relative to value added, manufacturing.)

The composition of implicit (value-added) price for pulp and paper mills is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(3.7	x	.295)	+	(0.5	x	.705)	=	1.4	1.3
Tot. lab., 1949-68[x]	(3.4	x	.372)	+	(0.2	x	.628)	=	1.4	1.4
Prod. lab., 1961-68[x]	(5.5	x	.323)	+	(-1.7	x	.677)	=	0.6	0.2
Tot. lab., 1961-68[x]	(5.6	x	.400)	+	(-2.6	x	.600)	=	0.7	0.2
Tot. lab., 1961-68[y]	(5.6	x	.396)	+	(-2.9	x	.604)	=	0.5	0.2

x – related to value added manufacturing
y – related to value added total activity
A – as calculated from this equation
B – as calculated by computer (see Table 16)

It must first be pointed out that the difference between the values produced by these equations and those obtained by least squares analysis of actual changes (see Table 16) largely result from the weak statistical significance (i.e. the poor trend fit) for short-period implicit price change and the equally weak significance of the full-period trend rates for unit residual cost. The lack of any strong trend in unit residual cost over the full period means that unit labour cost is the principal component of the price change; 78 percent in the first equation, 90 percent in the second. Over the short period the conflicting trends in unit labour and unit residual cost, increases in the former, decreases in the latter, tended to cancel each other out, producing little net change in implicit price.

In the same report that includes sections on synthetic textile mills and breweries the Dominion Bureau of Statistics (now Statistics Canada) reviewed trends in productivity in pulp and paper mills.[16] The data in that study and this one for the years covered by both are not the same because of revisions made to the measures of real output after publication of that report. However, it does contain considerable detailed analysis of a kind not found here although our study includes analysis of cost and price behaviour not found there. (Further information about this study is found at the conclusion of the sections in this chapter on breweries and synthetic textile mills.)

Printing, publishing and allied industries

Very little of this industry's output is exported but a substantial portion of domestic sales consist of imports. According to statistics compiled for this study from D.B.S. export and import data for 1965, only 1.7 percent of the value of the industry's production was exported in that year but 23.5 percent of the value of total market sales consisted of imports (see Table 1).

Printing, publishing and allied industries consist of: commercial printing (Standard Industrial Classification code 286) which includes establishments primarily engaged in commercial or job printing, including lithographing, bookbinding, silkscreen printing, etc.; engraving, stereotyping and allied industries (S.I.C. code 287) including establishments primarily engaged in engraving, photoengraving, electrotyping, etc. but not including engraving of jewellery or any engraving for purposes other than printing; publishing only (S.I.C. code 288) consisting of establishments primarily engaged in publishing that do not engage in printing or have some other principal activity, thus including publishing of books, newspapers, periodicals, maps, calendars, etc. but excluding the publication of house organs, etc.; printing and publishing (S.I.C. code 289) consisting of establishments primarily engaged in printing and publishing newspapers, magazines, periodicals, books, maps, etc.

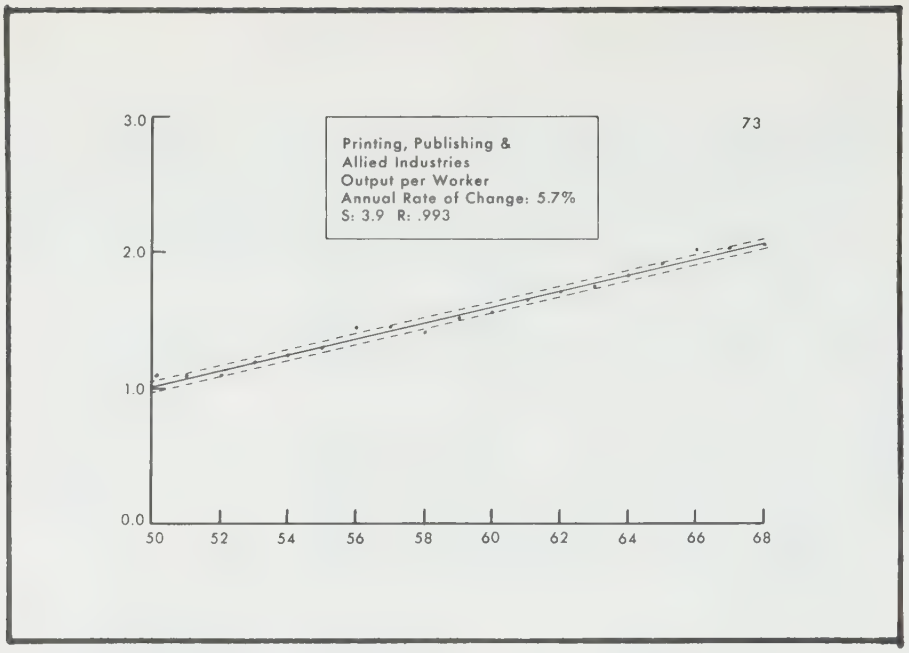
The introduction of the new Standard Industrial Classification in 1960 meant the reclassification and reorganization of some of the establishments in these industries (to be called "industry" here for simplicity's sake), but continuity of data between the old and new classifications is possible once the necessary adjustments are made (see Appendix A).

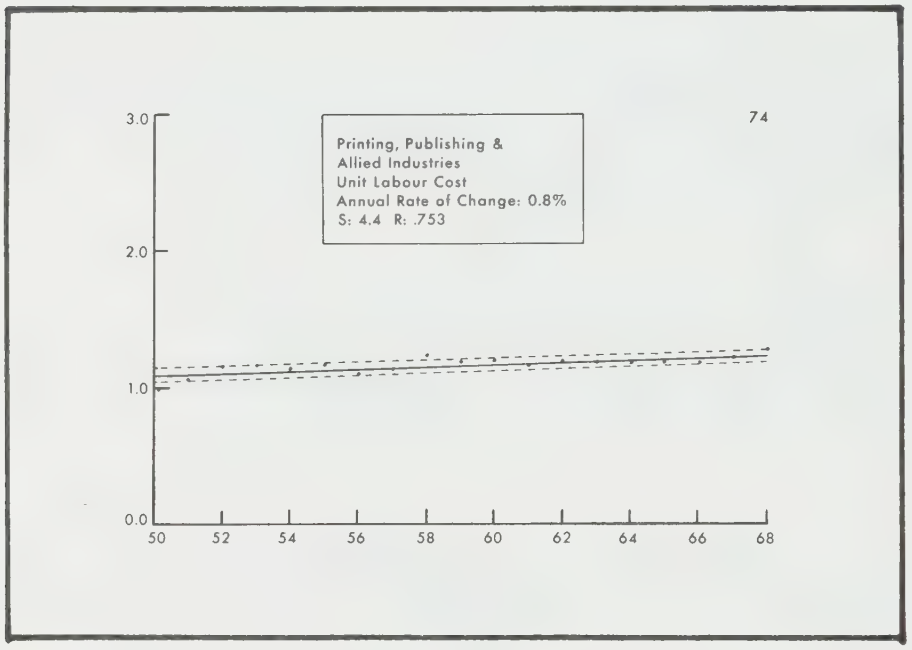
Both production and value added increased less than average in this industry over both the full and short periods. The increase in production of 125.4 percent between 1949 and 1968 was some 26 percent less than that for all manufacturing; the 26.7 percent increase between 1961 and 1968 fell 56 percent behind the average increase of 61.1 percent (see Table 2). The increases in value added were not as much below average, which is because of greater than average increases in implicit (value-added) price, discussed below. The rise of 224.9 percent in value added between 1949 and 1968 was 13 percent less

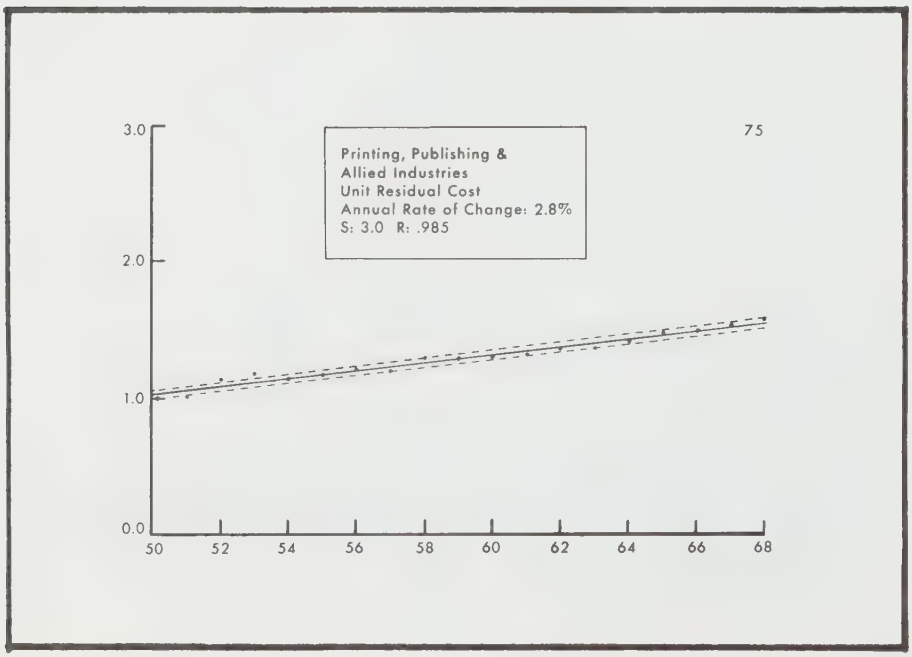
Summary Table — Principal Statistics

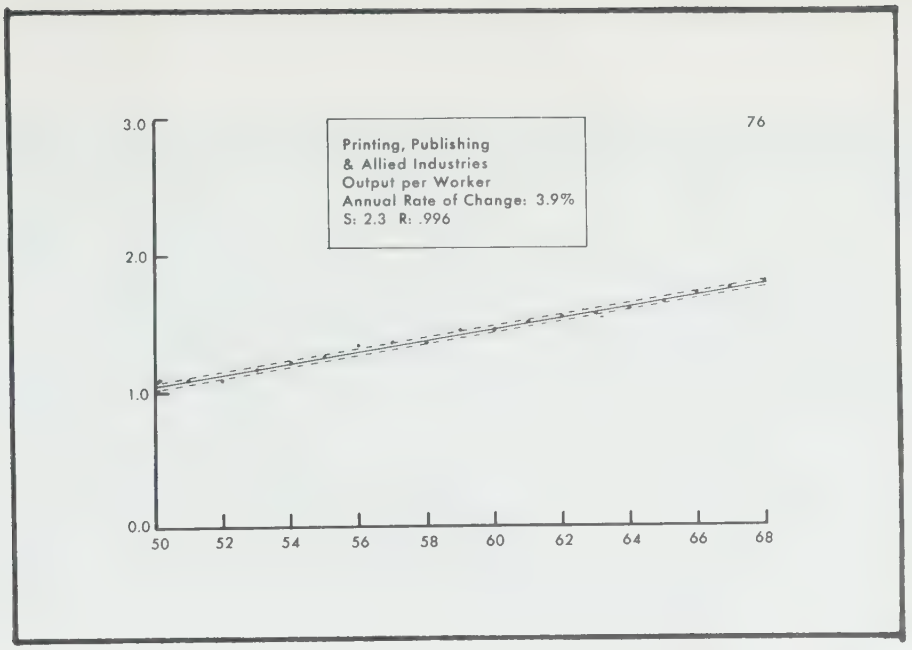
	1961 to 1968			1949 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			225.4			126.7			
Index of value added (1949 or 1961 = 100)			334.9			147.7		145.0	
Index of employment (1949 or 1961 = 100)	110.2	125.6		102.1	106.6				
Index of compensation per worker (1949 or 1961 = 100)	261.6	263.0		136.1	135.3				
Annual trend rate, compensation per worker	+7.5%	+7.3%		+4.8%	+5.4%				
Implicit, value-added price — index, 1949 or 1961 = 100			148.5			116.6		114.4	
— Annual trend rate of change			+2.2%			+1.9%		+2.2%	
— R value			.974			.766		.977	
Output per worker — index, 1949 or 1961 = 100	204.5	179.5		124.1	118.9				
— Annual trend rate of change	+5.7%	+3.9%		+3.7%	+3.1%				
— R value	.993	.996		.978	.990				
Unit labour cost — index, 1949 or 1961 = 100	127.9	146.6		109.7	113.8				
— Annual trend rate of change	+0.8%	+1.9%		+0.8%	+2.0%				
— R value	.753	.953		.644	.912				
Unit residual cost — index, 1949 or 1961 = 100	157.5	151.0		119.2	119.8		119.8		
— Annual trend rate of change	+2.8%	+2.3%		+2.7%	+2.5%		+2.6%		
— R value	.985	.971		.981	.936		.936		
Payroll as a proportion of value added 1949	30.0%	53.5%							
1961				27.5%	54.0%		52.6%		
1968	25.8%	52.7%					52.2%		
Trend rate of change in labour share	−1.0%	−0.3%		−1.1%	−0.3%		−0.3%		
— R value	.964	.703		.838	.371		.371		
Trend rate of change in residual share	+0.4%	+0.3%		+0.5%	+0.3%		+0.3%		

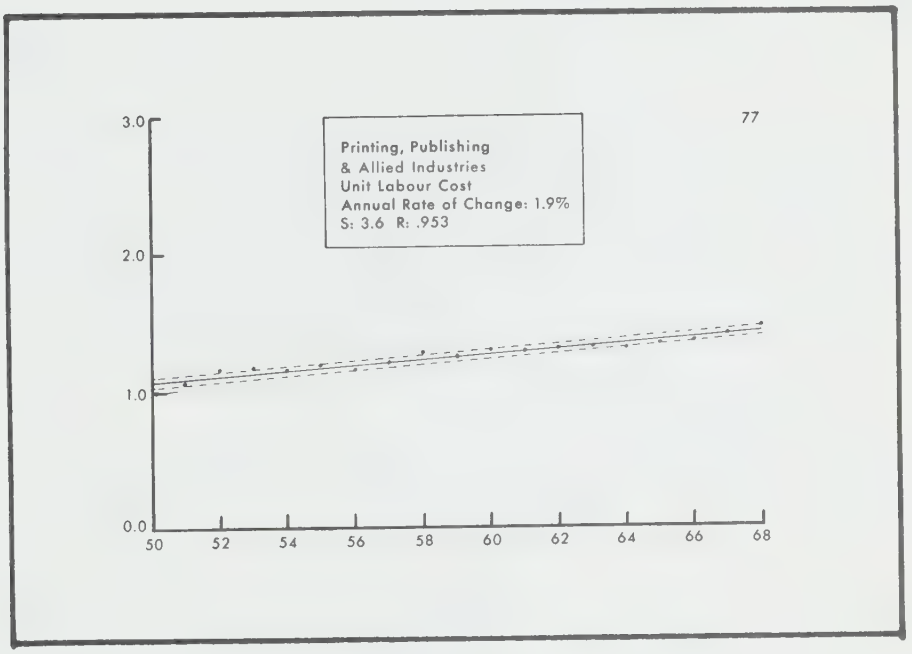
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

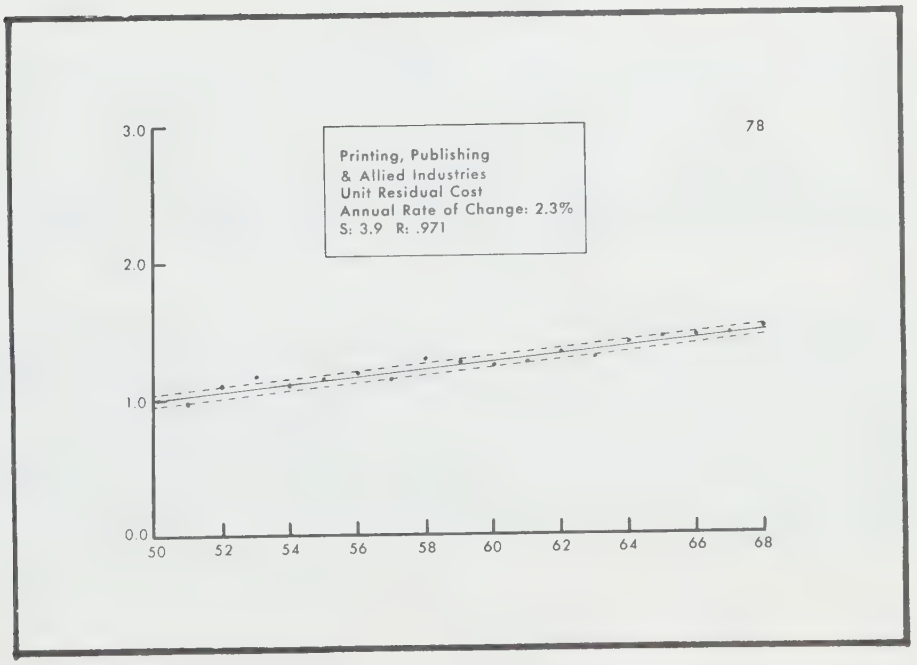

73
Printing, Publishing &
Allied Industries
Output per Worker
Annual Rate of Change: 5.7%
S: 3.9 R: .993
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


74
Printing, Publishing &
Allied Industries
Unit Labour Cost
Annual Rate of Change: 0.8%
S: 4.4 R: .753
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


75
Printing, Publishing &
Allied Industries
Unit Residual Cost
Annual Rate of Change: 2.8%
S: 3.0 R: .985
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


76
Printing, Publishing
& Allied Industries
Output per Worker
Annual Rate of Change: 3.9%
S: 2.3 R: .996
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


77
Printing, Publishing
& Allied Industries
Unit Labour Cost
Annual Rate of Change: 1.9%
S: 3.6 R: .953
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


78
Printing, Publishing
& Allied Industries
Unit Residual Cost
Annual Rate of Change: 2.3%
S: 3.9 R: .971
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68

than the average rise of 259.9 percent; the increase of 47.7 percent between 1961 and 1968 was 33 percent less than the average of 71.0 percent. The 45.0 percent increase over the short period in value added by total activity was 42 percent less than the 78.1 percent in all manufacturing.

Employment also increased less than average over both periods. The 10.2 percent increase in production worker employment between 1949 and 1968 was 62 percent less than 27.2 percent in all manufacturing, and between 1961 and 1968 the 2.1 percent increase was 89 percent less than the average of 19.7 percent (see Table 3). However, the 25.6 percent increase in total employment over the full period was not as far behind the rise of 32.8 percent for all manufacturing, the difference being 22 percent; but by 1961-1968 the gap widened, the 6.6 percent rise in this industry being 78 percent less than the 29.8 percent in all manufacturing. The growth of employment declined between 1961 and 1968 from what it had been between 1949 and 1960 and the decline was more pronounced for nonproduction than for production labour.

Between 1949 and 1968 the proportion of production labour to total employment fell from 55.6 to 48.8 percent, a drop of 12.3 percent; a strong statistically significant trend rate of decline of -0.8 percent per annum is indicated (see Table 5). While some other industries registered greater reductions in the production labour share, this percentage drop of 12.3 percent was greater than the all-manufacturing reduction of 4.2 percent, and the trend rate of decline was considerably greater than that for most industries. (Comparison with the trend rate for all manufacturing means little because that rate has no statistical significance.) This industry had the lowest relative employment of production labour of any of the industries studied and the only one in 1968 where the proportion was, at 48.8, below 50 percent.

Compensation (annual wages, annual wages and salaries) per worker increased exactly in line with the average for production workers over the full period, 161.6 percent in this industry and 161.5 percent in all manufacturing, and almost the same for total labour, 163.0 percent, compared with 166.5 percent in all manufacturing (see Table 9A). Over the short period increases in this industry fell behind; the rise of 36.1 percent for production labour was 18 percent less than the 43.9 percent in all manufacturing, while the rise of 35.3 percent for total labour was 23 percent less than the average of 45.9 percent. This relative decline is also apparent from the annual trend rates of increase: over the full period it was 7.5 percent for production labour in this industry, compared with 7.2 percent in all manufacturing, and 7.3 percent for total labour, compared with 7.5 percent in all manufacturing, over the short period, for production labour it was 4.8 percent, one-quarter less than the 6.3 percent in all manufacturing, and the rate of 5.4 percent for total labour was 14 percent less than the 6.3 percent in all manufacturing. The tendency for compensation per worker to show smaller increases over the recent period than over the full period, while common to most industries studied, was rather greater than average in this industry. For production labour annual wages per worker, average hourly earnings, and occupational wage rates showed similar increases (see Table 9A), with occupational wage rates increasing not quite so much over the full period. The 1949-1968 increases were 161.6 percent for annual wages, 168.4 percent for average hourly earnings and 154.9 percent for wage rates, while for 1961-1968 the increases were almost identical, at 36.0, 36.7 and 36.4 percent.

Implicit (value-added) price increased considerably more than average over both the full and short periods. The increase of 48.5 percent between 1949 and 1968 was 47 percent greater than the 33.0 percent in all manufacturing (see Table 12). The annual trend rate of increase of 2.2 percent was more than twice the 1.0 percent for all manufacturing; only three industries among those studied had greater rates (see Table 16). The increase of 16.6 percent between 1961 and 1968 was 168 percent greater than the 6.2 percent in all manufacturing. The annual trend rate of increase of 1.9 percent was more than twice the rate of 0.9 percent for all manufacturing; however, for this period ten of the industries had higher rates. With respect to value added by total activity, the increase in implicit price between 1961 and 1968 was 14.4 percent, 37 percent in excess of the 10.5 percent for all manufacturing; the trend rate of 2.2 percent was about one-third greater than the 1.7 percent in all manufacturing.

There are no industry selling price indexes for this industry group but the consumer (retail) price index for reading material increased 25.0 percent between 1961 and 1968 compared with an implicit (value-added, manufacturing) increase of 16.6 percent and an implicit (value-added, total activity) increase of 14.4 percent for the industry. The subindex for newspapers went up 38.0 percent and for magazines 5.2 percent. These retail price increases are presented by way of contrast with the implicit price increases. The differences might be explained by raw material or energy input costs (not counted in value added) or by higher or lower costs at the retail level or by the possibility, in the case of magazines, that the publisher absorbed part of the implicit (value-added) price increase. However, it is beyond the terms of this study to determine which explanations apply.

Increases in this industry in output per production worker were just about in line with the average over both time periods, while the increases with respect to total labour were below average. Between 1949 and 1968 output per production worker rose 104.5 percent, seven percent less than the 112.7 percent rise in all manufacturing (see Table 17). The annual trend rate of increase of 5.7 percent was just a little less than the 5.9 percent for all manufacturing. The increase between 1961 and 1968 with respect to production labour was 24.1 percent, almost one-third less than the 34.6 percent in all manufacturing, but the annual trend rate of increase of 3.7 percent was the same for this industry and all manufacturing. The difference in the 1961-1968 percentage increase and trend rate of change is explained by a levelling off between 1966 and 1968 which can be seen in the chart.

With respect to total labour, output per worker increased 79.5 percent between 1949 and 1968, 23 percent less than the increase of 103.7 percent in all manufacturing. Between 1961 and 1968 there was an increase of 18.9 percent, 22 percent less than the increase of 24.1 percent in all manufacturing, and the annual trend rate of increase of 3.1 percent was 20 percent less than the average rate of 3.9 percent.

The rates of increase in labour productivity (output per worker) over both periods were less in this industry for total than for production labour, whereas in all manufacturing they were about the same. In both this industry and all manufacturing the rate of increase for production labour was one-third less in the short period than over the full period. For total labour the short-period rate of increase was 20 percent less in this industry but one-third less in all manufacturing.

Increases in unit labour cost were greater than average over the full period, while over the short period they were less than average with respect to production labour and about average for total labour. While unit labour cost increases accelerated in the 1960's in manufacturing generally, there was little change in printing and publishing.

Unit labour cost for production labour went up 27.9 percent in this industry between 1949 and 1968, 21 percent more than the 23.0 percent rise in all manufacturing (see Table 24). The annual trend rate of increase was 0.8 percent, 60 percent greater than the rate in all manufacturing. However, eight of the industries studied had higher rates (see Table 26). Between 1961 and 1968, also for production labour, unit labour cost increased 9.7 percent, or a little more than the 6.9 percent in all manufacturing, but the annual trend rate of increase of 0.8 percent, the same as for the full period, was 60 percent less than the rate of 2.0 percent in all manufacturing. (The contrast between the relatively greater 1961-1968 percentage increase and smaller trend rate is explained by the comparative stability from 1962 to 1966 and the jump in 1967 and 1968, which can be seen in the chart and Table 24.)

Unit labour cost increased much more for total labour than for production labour alone. Between 1949 and 1968 the increase was 46.6 percent in this industry, 61 percent more than the increase of 30.8 percent in all manufacturing. The annual trend rate of increase of 1.9 percent was close to 2 1/2 times the 0.8 percent rate for production labour, and almsot 2 3/4 times the 0.7 percent in all manufacturing. However, five of the industries studied had higher rates (see Table 26). Between 1961 and 1968 the increase in this industry was 13.8 percent, which was 22 percent less than the 17.6 percent in all manufacturing. The annual trend rate of increase of 2.0 percent, little changed from the 1.9 percent for the full period, was still 2 1/2 times the rate for production labour, but was almost the same as the 1.9 percent in all manufacturing in contrast with the considerable difference between the two rates for the full period.

Unit residual cost increased considerably more than average not only over the full period, as did unit labour cost, but also over the short period, which was not so for the other measure. In this industry the rate of change, relative to production labour, remained virtually constant over both time periods while the rate relative to total labour was a little higher over the short period. The increases with respect to production labour were somewhat greater than those related to total labour, indicating that unit nonproduction labour cost was rising more rapidly than straight unit residual cost. This is because nonproduction labour cost is part of unit residual cost relative to production labour, but not when that measure is related to total labour.

Between 1949 and 1968 unit residual cost with respect to production labour moved up 57.5 percent, almost 50 percent more than the 38.9 percent rise in all manufacturing (see Table 28). The annual trend rate of increase of 2.8 percent was 115 percent greater than the average rate of increase of 1.3 percent. Only two of the industries studied registered higher rates (see Table 31). Between 1961 and 1968, still with respect to production labour, unit residual cost increased 19.2 percent in this industry, almost 3 1/3 times as much as the 5.8 percent in all manufacturing. The annual trend rate of increase was 2.7 percent, compared with a situation of no net change in all manufacturing. Nevertheless, eight industries had greater rates of increase and two others had almost identical rates, but seven others showed rates of decline.

Unit residual cost relative to total labour was 51.0 percent greater in 1968 than in 1949, which was also 45 percent greater than the 35.1 percent for all manufacturing. The annual trend rate of increase was 2.3 percent, some 18 percent less than the 2.8 percent relative to production labour but almost double the rate of 1.2 percent for all manufacturing. Only four of the industries studied had higher rates of increase. Between 1961 and 1968 there was an increase of 19.8 percent, while in all manufacturing there was a drop of 1.2 percent. The annual trend rate of increase of 2.5 percent was slightly less than the 2.7 percent with respect to production labour and compares with no net change in all manufacturing. Eleven of the industries studied had higher rates of increase, and there were six others with negative rates, with the result that for all manufacturing there was virtual stability of unit residual cost over the short period. Measured in relation to value added by total activity, rather than by manufacturing only, and with respect to total labour (no such measure being computed relative to production labour only), unit residual cost increases between 1961 and 1968 in printing and publishing were almost identical with the measures related to value added, manufacturing: a 1961-1968 increase of 19.8 percent compared with 19.7 percent, a trend rate of increase of 2.6 percent compared with 2.5 percent. However, the total activity measure in all manufacturing behaved quite differently from the manufacturing activity measure, so that the trend rate of increase in this industry of 2.6 percent compares with a rate of increase of 1.6 percent in all manufacturing instead of a situation of virtually no change in the measure related to manufacturing activity.

There was a steady and statistically significant decline in the production labour share of value added throughout the time period studied and a less significant decline in the total labour share. The production labour share was 30.0 percent in 1949, dropped to 27.5 percent in 1961 and to 25.8 percent by 1968. This constituted a trend rate of decline of -1.0 percent per annum, a stronger rate of decline than the -0.4 percent for all manufacturing. Between 1961 and 1968 the rate was -1.1 percent, while over this period in all manufacturing there was a rate of increase of 1.1 percent. This has not been one of the least labour intensive industries - eight of the industries having smaller labour shares in 1949 - but its 1949, 1961 and 1968 shares for production labour were all less than those for all manufacturing.

The total labour share actually went up slightly from 53.5 percent in 1949 to 54.0 percent in 1961 before moving down to 52.7 percent in 1968. The annual trend rate was -0.3 percent for both the full and short periods, but is of questionable statistical significance for the short period with an R value of only .371. The seemingly erratic movements of the total labour share between 1961 and 1968 can be seen from Table 34, Column B. Considering that there is less than one percentage point difference between the 1949 and 1968 total labour shares, the conclusion follows that this share has remained constant, that whatever decline there has been in the share for production labour has been offset by an increase in the share for nonproduction labour. This is because of a steady decline in the relative employment of production lablour which was noted earlier.

The composition of implicit (value-added) price for printing, publishing and allied industries is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.8	x	.300)	+	(2.8	x	.700)	=	2.2	2.2
Tot. lab., 1949-68[x]	(1.9	x	.535)	+	(2.3	x	.465)	=	2.1	2.2
Prod. lab., 1961-68[x]	(0.8	x	.275)	+	(2.7	x	.725)	=	2.2	1.9
Tot. lab., 1961-68[x]	(2.0	x	.540)	+	(2.5	x	.460)	=	2.2	1.9
Tot. lab., 1961-68[y]	(2.0	x	.535)	+	(2.6	x	.465)	=	2.3	2.2

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

(The reasons for differences in the figures in columns A and B have been discussed in some of the preceding sections covering other industries and need no repetition here. See especially the section on slaughtering and meat processors, the first industry covered in this chapter.)

Production labour cost itself was only about ten percent of implicit price change over both periods. (Thus, in the first equation, 0.8 x .300 = .24, which is 10.9 percent of the 2.2 in column A.) With total labour taken into account, the labour cost component was almost but not quite half, and this was so for both the full and short periods, and with respect to value added, total as well as value added, manufacturing.

Iron and steel mills

In 1965, on the basis of data especially compiled for this study from commodity foreign trade statistics, 10.4 percent of the value of the output of iron and steel mills was exported while 20.2 percent of the value of total market sales of products of this industry consisted of imports (see Table 1). Therefore, while foreign trade was important to the industry, it was not nearly as important as the domestic market. Iron and steel mills produce very little, if anything, that is ready for direct sale to the consumer but supply a very important raw material for industries producing durable goods for the consumer (automobiles, electrical appliances, etc.) and others that produce structural and other forms of steel used in building construction , bridges, aircraft, other transportation equipment, and so on. In short, its importance to the domestic economy cannot be easily exaggerated.

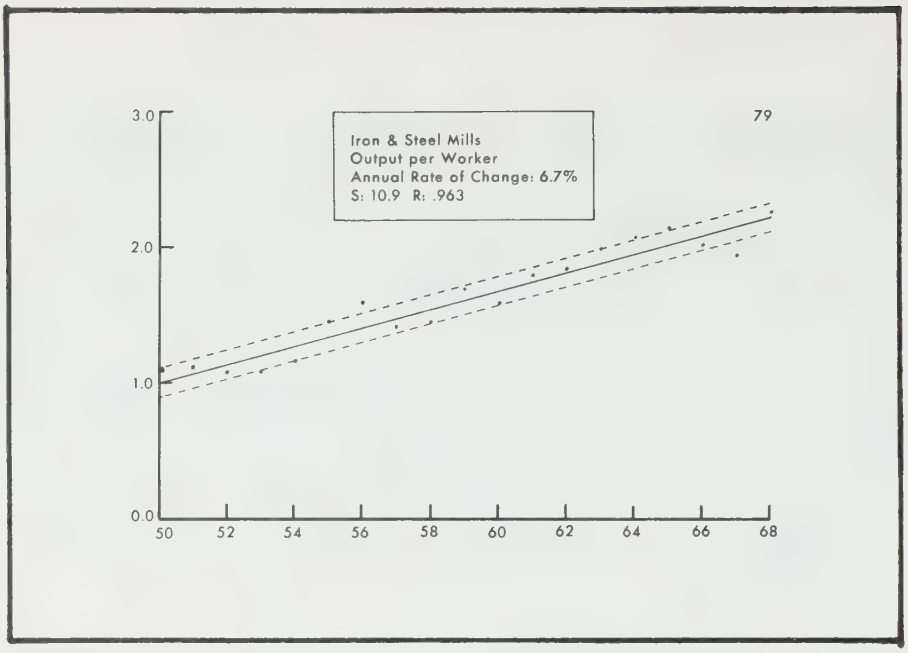
Data on iron and steel mills (Standard Industrial Classification 291) are in essential continuity with what was called, under the classification in effect up to 1960, primary iron and steel. Some adjustments are necessary to secure continuity between the old and new statistical series, which are described in Appendix A. Four main types of establishments are classified in this industry: those primarily engaged in manufacturing pig iron and ferro-alloys; steel works primarily engaged in manufacturing ingots, steel castings and continuous casting of steel; rolling mills; and coke ovens operated in connection with blast furnaces.

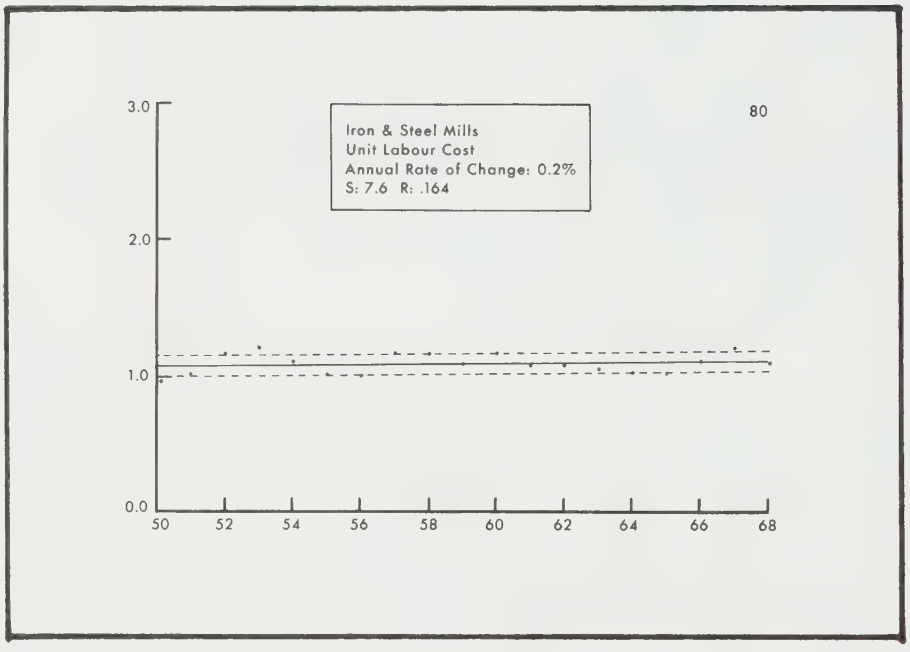
IRON AND STEEL MILLS

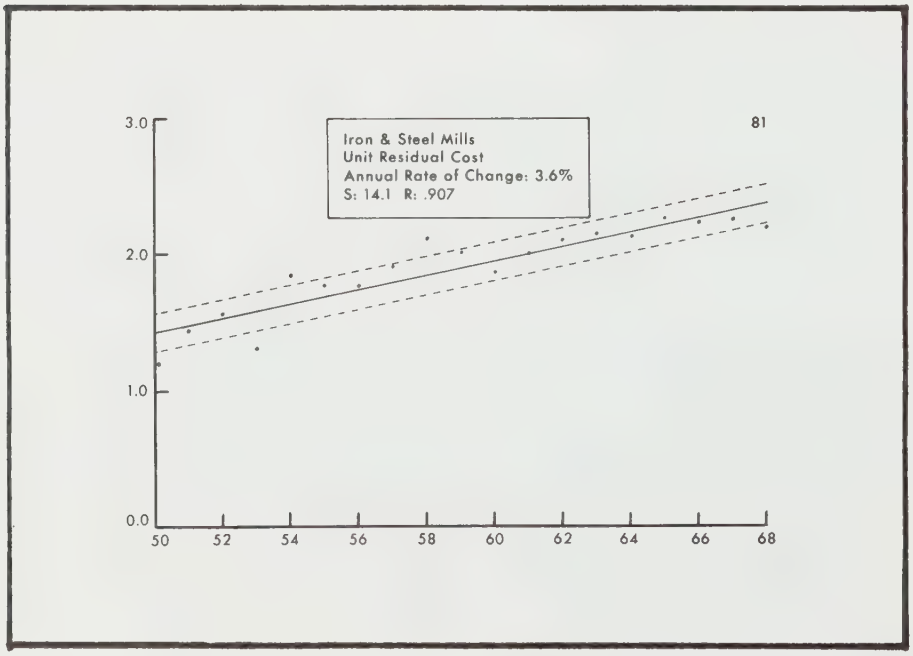
Summary Table — Principal Statistics

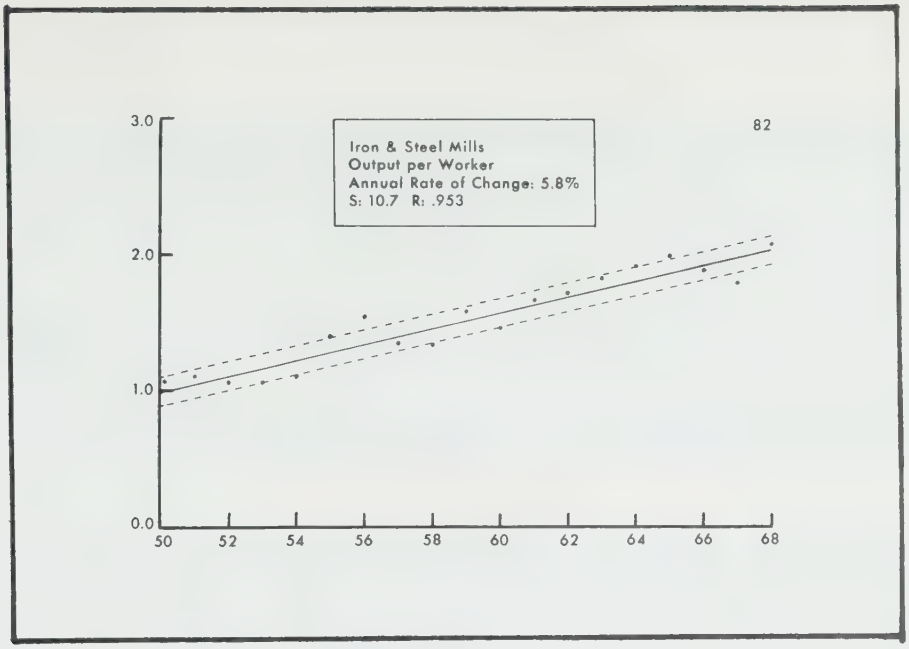
	1949 to 1968			1961 to 1968					
	Value added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			314.6			161.4			
Index of value added (1949 or 1961 = 100)			509.2			172.3		170.9	
Index of employment (1949 or 1961 = 100)	139.1	151.4		127.8	128.4				
Index of compensation per worker (1949 or 1961 = 100)	248.8	254.2		128.6	130.0				
Annual trend rate, compensation per worker	+7.2%	+7.4%		+3.9%	+4.3%				
Implicit, value-added price — index, 1949 or 1961 = 100			161.8			106.7		105.8	
— Annual trend rate of change			+2.1%			+1.2%		+1.2%	
— R value			.867			.761		.757	
Output per worker — index, 1949 or 1961 = 100	226.1	207.8		126.2	125.7				
— Annual trend rate of change	+6.7%	+5.8%		+2.1%	+2.1%				
— R value	.963	.953		.642	.638				
Unit labour cost — index, 1949 or 1961 = 100	110.1	122.3		101.9	103.5				
— Annual trend rate of change	+0.2%	+0.7%		+1.6%	+2.1%				
— R value	.164	.462		.563	.603				
Unit residual cost — index, 1949 or 1961 = 100	219.2	223.6		109.7	109.7		108.1		
— Annual trend rate of change	+3.6%	+3.7%		+0.7%	+0.1%		+0.5%		
— R value	.907	.892		.496	.057		.284		
Payroll as a proportion of value added 1949	52.5%	60.9%							
1961				37.4%	47.5%		47.2%		
1968	35.7%	46.0%					46.1%		
Trend rate of change in labour share	−1.5%	−1.0%		+0.4%	+0.8%		+0.9%		
— R value	.822	.724		.221	.361		.386		
Trend rate of change in residual share	+1.2%	+1.2%		−0.4%	−1.0%		−0.7%		

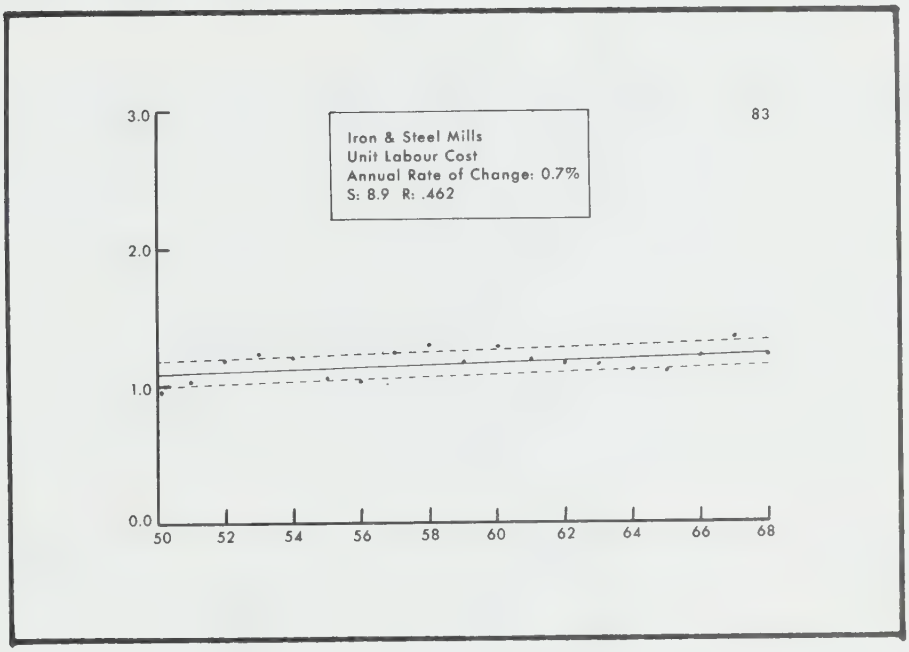
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

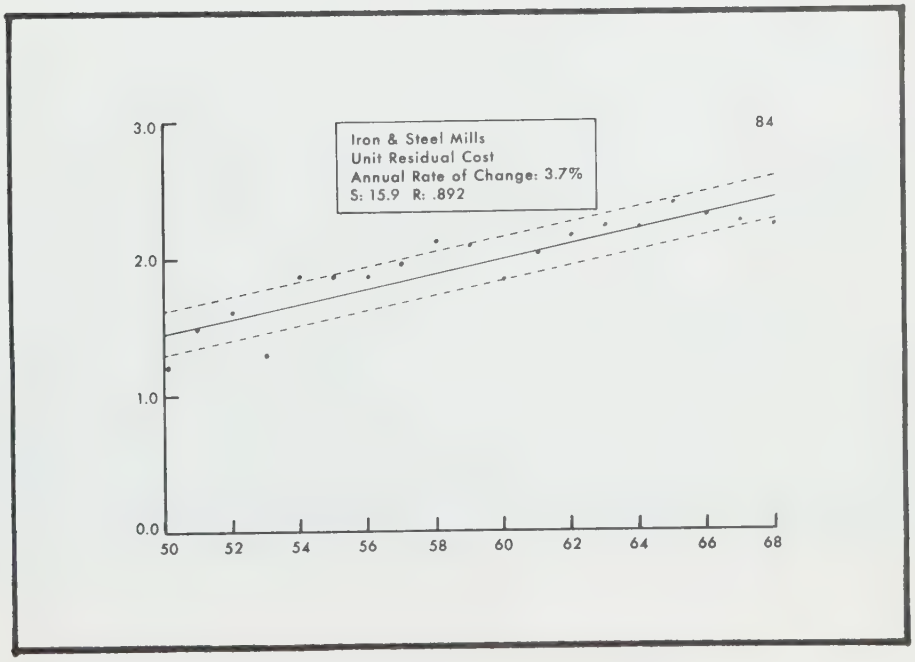

79
Iron & Steel Mills
Output per Worker
Annual Rate of Change: 6.7%
S: 10.9 R: .963
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


80
Iron & Steel Mills
Unit Labour Cost
Annual Rate of Change: 0.2%
S: 7.6 R: .164
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


81
Iron & Steel Mills
Unit Residual Cost
Annual Rate of Change: 3.6%
S: 14.1 R: .907
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


82
Iron & Steel Mills
Output per Worker
Annual Rate of Change: 5.8%
S: 10.7 R: .953
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


83
Iron & Steel Mills
Unit Labour Cost
Annual Rate of Change: 0.7%
S: 8.9 R: .462
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


84
Iron & Steel Mills
Unit Residual Cost
Annual Rate of Change: 3.7%
S: 15.9 R: .892
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Between 1949 and 1968 production and value added increased significantly more than average but between 1961 and 1968 the increases were in line with the average. Over the full period production increased 214.6 percent, 26 percent more than the 170.6 percent for all manufacturing, while over the short period the increase of 61.4 percent was almost identical with the average of 61.1 percent (see Table 2). Over the full period value added increased 409.2 percent, 57 percent more than the 259.9 percent for all manufacturing, but over the short period the increase of 72.3 percent was almost the same as the average of 71.0 percent.

Trend rates were not computed for production or value added but inspection of the yearly indexes in Table 2 reveals very wide year-to-year fluctuations; for example, an increase of 6.6 percent in production between 1949 and 1950, followed by an 18.9 percent jump between 1950 and 1951, stability for two years, then a drop of 14 percent between 1953 and 1954, then an increase over the next year of 42.7 percent - and so on; similarly, for value added. This instability in real and current value output may be the reason for the weak trend in unit labour cost (discussed later) over both time periods and in unit residual cost over the recent period.

Employment of production labour went up by more than average over both time periods and over the full period for total labour but not over the short period. The increase of 39.1 percent in production labour employment between 1949 and 1968 was 44 percent greater than the average 27.2 percent increase; the 1961-1968 increase of 27.8 percent exceeded by 41 percent the average of 19.7 percent (see Table 3). Total labour employment moved up 51.4 percent over the full period, 57 percent more than the 32.8 percent in all manufacturing, but the increase of 28.4 percent over the short period was slightly less than the average of 29.8 percent. As with production, employment movements followed an erratic path over the years, as indicated by the index numbers for the industry in Table 3.

As in most industries studied, there was a fairly steady reduction in the employment of production labour relative to total labour except that the downward trend was stronger in this than in most other industries (see Table 5). The proportion dropped from 89.1 percent in 1949 to 81.9 percent in 1968, a reduction of 8.1 percent, and an annual trend rate of -0.4 percent. However, in 1968 the industry still had a larger than average relative employment of production labour, 81.9 percent, compared with 77.7 percent for all manufacturing; only five industries had larger proportions.

Compensation (annual wages, annual wages and salaries) per worker increased at about the average rate over the full period and less than average over the short period. The increase between 1949 and 1968 for production workers was 148.8 percent, eight percent less than the 161.5 percent in all manufacturing (see Table 9A), but this small divergence from all manufacturing would be accounted for by minor differences in year-to-year changes because the annual trend rate of increase of 7.2 percent was the same for this industry and all manufacturing. Between 1961 and 1968 compensation per production worker increased 28.6 percent, 35 percent less than the rise of 43.9 percent in all manufacturing, and the annual trend rate of increase of 3.9 percent was 38 percent less than the average rate of 6.3 percent. This industry had a much lower rate of increase in annual compensation per production worker than in any of the other industries covered by this study (see Table 11).

Annual wages per worker increased a little less over the full period than occupational wage rates and fell even more behind average hourly earnings. The increases were 148.8, 155.4 and 175.6 percent, respectively (see Table 9A). The irregular employment pattern described above suggests that layoffs and/or work stoppages may have accounted at least partly for the slower increase in annual earnings, while overtime pay may explain at least part of the greater increase in average hourly earnings. However, it is beyond the terms of this study to investigate such matters. The differences in the increases disappear when 1961-1968 is the period of reference; annual wages per worker, average hourly earnings, and wage rates increased 28.6, 28.7 and 28.5 percent respectively.

For total labour, compensation (i.e., annual wages and salaries) per worker increased 154.2 percent over the full period, seven percent less than the increase of 166.5 percent in all manufacturing. The annual trend rate of increase of 7.4 percent was slightly more than the 7.2 percent for production labour only and very slightly less than the 7.5 percent in all manufacturing. The short-period increase of 30.0 percent was 35 percent less than the average increase of 45.9 percent. As with most of the industries studied, the annual trend rate of increase for the short period was less than for the full period, 4.3 percent compared with 7.4 percent, but it was more than the short-period trend rate for production labour of 3.9 percent, and one-third less than the 6.3 percent for all manufacturing. Only one industry had a lower rate and one other had the same rate (see Table 11).

Implicit (value-added) price increased more than average over both the full and short periods, but the margin was much less over the short period. Between 1949 and 1968 there was an increase of 61.8 percent, 87 percent more than the increase of 33.0 percent for all manufacturing (see Table 12); the annual trend rate of increase of 2.1 percent was more than twice the 1.0 percent for all manufacturing. Only four of the industries studied registered higher rates over this period (see Table 16). The situation over the short period is significantly different. The increase between 1961 and 1968 was 6.7 percent, only a trace more than the 6.2 percent in all manufacturing, while the annual trend rate of increase of 1.2 percent was one-third greater than the 0.9 percent for all manufacturing, whereas over the full period the margin was 120 percent. Indeed 13 of the industries studied had greater rates of increase over this period, compared with four over the full period.

Implicit price with respect to value added by total activity increased 5.8 percent over the short period, or almost half the increase of 10.5 percent for all manufacturing. The trend rate of 1.2 percent, the same as for value added, manufacturing, was about one-third less than the 1.7 percent for all manufacturing.

The industry selling price index, which reflects price changes in the industry at the factory shipment or wholesale level, increased only 3.0 percent for iron and steel mills between 1961 and 1968, compared with implicit price increases of 6.7 and 5.8 percent for value added, manufacturing and value added, total activity, respectively. This means that part of the implicit price increase was offset by lower raw material and energy costs or that the distribution section of the industry absorbed part of the implicit price rise.

Labour productivity (i.e., output per worker) increased somewhat more than average for production labour over the full period and less than average over the short period, while for total labour it increased at the average rate over the full period and less than average over the short period.

Between 1949 and 1968 output per production worker rose 126.1 percent, about 12 percent more than the 112.7 percent for all manufacturing (see Table 17), while the annual trend rate of increase of 6.7 percent exceeded the 5.9 percent for all manufacturing by almost 14 percent. However, 12 of the industries studied had higher rates of increase over the full period (see Table 19). Between 1961 and 1968 the increase was 26.2 percent, almost one-quarter less than the increase of 34.6 percent for all manufacturing. The annual trend rate of increase was 2.1 percent, considerably down from the 6.7 percent for the full period (but, then, a lower rate was the case with most of the industries studied), and 43 percent less than the 3.7 percent for all manufacturing. Only four industries had lower rates of increase.

While the trend shows a good fit over the full period (R = .963) and reasonably good over the short period (R = .642), there were strong fluctuations over the years studied. This can be observed from the chart and from the index numbers in Table 17. From 1949 to 1953 output per production worker changed very little, then jumped 47.0 percent over the next three years, dropped almost 11 percent between 1956 and 1957, paused for one year, increased 16.4 percent in the next year, then dropped 5.9 percent, followed by a rise of 35.1 percent between 1960 and 1965, then a decline of 8.8 percent between 1965 and 1967 and a jump of 16.2 percent from 1967 to 1968. Any observations about productivity trends in iron and steel mills must be made in the light of these marked fluctuations over the 20 years under review. This also applies to what is next said about productivity of total labour.

Over the full period output per worker for total labour increased 107.8 percent, about the same as the 103.7 percent in all manufacturing. The annual trend rate of increase of 5.8 percent, while less than the 6.7 percent for production labour only, was the same as for all manufacturing. Twelve industries of those studied had higher rates (see Table 19). Over the short period the increase was 25.7 percent, slightly more than the 24.1 percent for all manufacturing, but the trend rate of increase of 2.1 percent per annum, while the same as that for production labour only, was almost 50 percent less than the 3.9 percent for all manufacturing as against no difference over the full period. Four of the industries studied had lower rates of increase and one had a rate of decrease. The sharp fluctuations from year to year are demonstrated by the fact that while the 1961-1968 percentage increases are almost the same for iron and steel mills and all manufacturing, there was a marked difference in the annual trend rates.

Probably the most remarkable feature of both unit labour and unit residual cost in this industry is the confused trends that are derived from the data: a lack of any statistically significant linear trend for unit production labour cost over the full period and rather weak trends in the other cases; strong trends in unit residual cost over the full period, weaker or nonexistent trends over the short period. Computation of nonlinear trends for unit labour cost over the full period improved the fit somewhat (see Appendix C). This, of course, has implications for the analysis of the cost components of price change, which are discussed further on, and no doubt explains the lack of significant trends in the change of the labour share over the short period, which is also discussed later in this section.

From 1949 to 1968 unit labour cost for production labour increased 10.1 percent (see Table 24). A comparison of this increase with the 23.0 percent increase for all manufacturing is meaningless because of the vagaries of this measure for iron and steel mills. If the period examined is 1967 over 1949, the increase for this industry is 21.6 percent, exactly the same for all manufacturing. The charts illustrate this phenomenon. This is why the annual trend rate of increase of 0.2 percent must be taken as of no significance; the R value (measure of goodness of fit) is only .164. On balance, during the 1950's there was no change; during the 1960's there was little change from 1961 to 1965, a sudden increase over the next two years and an equally sudden reduction in the final year. For this reason the annual trend rate of increase of 1.6 percent can be taken as having some significance but principally because of the jump from 1965 to 1967 coupled with no change over all of the other years but the last when there was a move downward. The fact that the increase between 1961 and 1968 was only 1.9 percent illustrates the "no net change" situation.

With respect to total labour there is a more definite indication of an upward trend although the fit is much less than for most of the industries studied (see Table 26). There was an increase of 22.3 percent between 1949 and 1968, compared with 30.8 percent for all manufacturing, but, as with production labour only, if 1967 is compared with 1949, the increases are much greater at 35.0 and 29.2 percent, demonstrating the irregular pattern. The annual trend rate of increase of 0.7 percent

was the same as that for all manufacturing with nine industries having higher rates over this period. Over the short period the rate of increase was much higher, at 2.1 percent, higher also than the rate of 1.6 percent for production labour only and slightly higher than the 1.9 percent for all manufacturing. However, 12 of the industries studied had higher rates. For reasons that are now clear, the 3.5 percent increase between 1961 and 1968 is of no significance, compared with the 17.6 percent for all manufacturing.

For unit residual cost there is the interesting phenomenon of well-fitting statistical trends over the full period and poor fits, indeed in one case a nonexistent fit, over the short period. The reason for this would require much space to be devoted to the mathematics of these trend computations (which are discussed in general terms in Appendix C) as well as discussion of the year-to-year fluctuations. Essentially, as has been explained many times already, it arises out of erratic behaviour in the short period that, when joined with the data for the earlier years, produces a more regular pattern over the full period. It should also be observed that in these cases (as in many other industries) when there is a poor fit, the trend rate of change is also small, so that it is a rather negligible component of implicit price change.

Over the full period unit residual cost increased substantially and slightly more with respect to total than with respect to production labour. From 1949 to 1968 unit residual cost relative to production labour increased 119.2 percent, more than three times as much as the increase of 38.9 percent for all manufacturing (see Table 28). The annual trend rate of increase, at 3.6 percent, was 2 3/4 times the rate of 1.3 percent for all manufacturing. Only two industries had higher rates (see Table 31). Over the short period there was a much weaker trend but still some indication of a continuing but more moderate increase. The annual trend rate of increase was 0.7 percent, which was the lowest of all the 14 rates of increase shown in Table 31, which, however, also shows rates of decrease for seven other industries.

With respect to total labour unit residual cost increased 123.6 percent over the full period, or 3 1/2 times as much as the 35.1 percent for all manufacturing. The trend rate of increase was 3.7 percent per annum, more than three times the 1.2 percent for all manufacturing. Only two industries among those studied had higher rates. Over the short period, with a computed trend rate of 0.1 percent and an indication of no statistical significance ($R = .057$), it can only be said that there was a situation of no net change. It is true that the 1968 index is 11.9 percent higher than that for 1961 but that is only because the 1961 value was the lowest for that period; between 1962 and 1968 there was a change of only 2.6 percent. Similar observations can be made for unit residual cost over the short period with respect to total labour and value added by total activity.

For reasons similar to those given for unit residual cost, there was a statistically significant downward trend in the labour share of value added over the full period, somewhat less so for total than for production labour only, and no significant trend at all over the short period. The production labour share dropped considerably from 52.5 percent in 1949 to 37.4 percent in 1961 and 35.7 percent in 1968. The share in the final year was one-third less than in 1949. Most of the reduction occurred in the 1950's and the lack of statistical significance ($R = .221$) of the trend rate of change for the short period bears this out. Analysis of the annual indexes in Table 34 reveals the frequent reverses from increases to decreases and vice-versa, in the production labour share; for the period 1949 to 1960 the share declined seven times and increased four times and the share in 1960 was 22 percent less than in 1949. Between 1961 and 1968 there were five reductions and two increases but the net reduction from 1961 to 1968 was only 4 1/2 percent. Rather similar conclusions can be drawn from examination of the data for total labour.

The annual trend rate of decrease of -1.5 percent in the production labour share, while greater than the rate of -0.4 percent for all manufacturing, was not the largest; four industries had greater rates of decrease and one other had the same (see Table 36). In 1949 this share, at 52.5 percent, was more than 40 percent in excess of the 36.8 percent for all manufacturing, but by 1968, the 35.7 percent in this industry was only five percent above the 34.0 percent for all manufacturing.

The total labour share declined from 60.9 percent in 1949 to 47.5 percent in 1961 to 46.0 percent in 1968, a drop of 25 percent altogether, compared with a one-third reduction for production labour only. As with production labour, most of the reduction occurred in the 1950's and there was no clear trend in the 1960's. Over the full period the annual trend rate of decline was -1.0 percent, which was greater than the rate of decline of -0.2 percent for all manufacturing,[17] and exceeded in only two of the industries studied (see Table 36). In 1949 the total labour share was 25 percent greater than that for all manufacturing, but by 1968 it was four percent less.

Because of the seemingly erratic fluctuations in the labour share, which is also used as the weight in computing trends in unit residual cost and residual share (explained in Chapter Three), it will be understood that current-weighted computations of these measures are likely to differ from the base-weighted computations appearing in the tables and that have been discussed. In industries with little or only gradual steady change in one direction, the computed measures are likely to be much the same either way. That is not so in this industry and a few of the others covered in our study. A comparison of base-weighted and current-weighted computations may be obtained upon request from the Canada Department of Labour, Economics and Research Branch.

The composition of implicit (value-added) price for iron and steel mills is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.2	x	.525)	+	(3.6	x	.475)	=	1.8	2.1
Tot. lab., 1949-68[x]	(0.7	x	.609)	+	(3.7	x	.391)	=	1.9	2.1
Prod. lab., 1961-68[x]	(1.6	x	.374)	+	(0.7	x	.626)	=	1.0	1.2
Tot. lab., 1961-68[x]	(2.1	x	.475)	+	(0.1	x	.525)	=	1.1	1.2
Tot. lab., 1961-68[y]	(2.1	x	.472)	+	(0.5	x	.528)	=	1.3	1.2

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

The difference between the column A rates of implicit price change, which are the results of the equations, and the column B rates taken from Table 16, which are the least squares computations of trend rates from the annual implicit price data, arise from the fact that some of the trend rates in the above equations are of little statistical significance either because there is no trend at all or it is a nonlinear trend that cannot, of course, be expressed in terms of an annual rate of change. (This is discussed further in some of the industry sections, notably that for slaughtering and meat processors, and more fully in Appendix B.)

In the first two equations the rates for unit labour cost are of doubtful statistical validity and this is true of unit residual cost in the last three equations. However, in each of these equations it is the unit cost measure with a statistically significant trend that is the principal component of the price change. In the first equation unit residual cost constitutes 95 percent of the implicit price change (3.6 x .475 is 1.7 which is 95.0 percent of 1.8 appearing in column A); in the second equation it constitutes 76.1 percent. In the next three equations unit labour cost is the important element; in equation three it constitutes 59.8 percent of the implicit price change, in the fourth equation, 90.7 percent, and in the fifth equation, 76.3 percent. Only in the case of the third equation covering production labour in the short period does unit residual cost assume very much importance, and in the last two equations the trend rates for unit residual cost are not statistically significant.

In concluding this section, reference must be made to two other studies of this industry. One was published in February 1970 by the Dominion Bureau of Statistics.[18] This report contains data on output per manhour as well as per worker, which our study has not done, for reasons explained previously (see Chapter Five). It will be useful to the interested reader for this and other information not found here. The basic output data were taken from the D.B.S. report on real domestic product (Catalogue No. 61-506), published in July 1968 and replaced by data published in February 1971 (Catalogue No. 61-510) which for four of the years between 1962 and 1967 were revised downwards and for two years revised upwards from the data previously published. Our study is based on the more recent data and shows lower increases in productivity for the reason just given. Furthermore, our data on employment are not quite the same as in this special D.B.S. study because of adjustments we have made to establish continuity with earlier years not covered in the D.B.S. study.

The other report is a study by the Prices and Incomes Commission, *Steel and Inflation*, also published in February 1970. It examines production, costs and prices over recent years in disaggregative terms; for example, one table details costs per ton (in current dollars) of rolling mill shipments, another table contains detailed price data for a wide variety of rolling mill products, and so on. Such detailed analysis was not a purpose of the research embodied in our study which traces aggregative and net behaviour of productivity, costs and prices in selected industries for comparison with one another.

Agricultural implements

Both export and import trade are of great importance to this industry. On the basis of statistics compiled from commodity data for this study, exports in 1965 accounted for 59.8 percent of the value of production, while imports that year accounted for 75.1 percent of total domestic market sales (see Table 1).[19] The industry does not directly meet the needs of consumers as such but is obviously of great importance to agriculture.

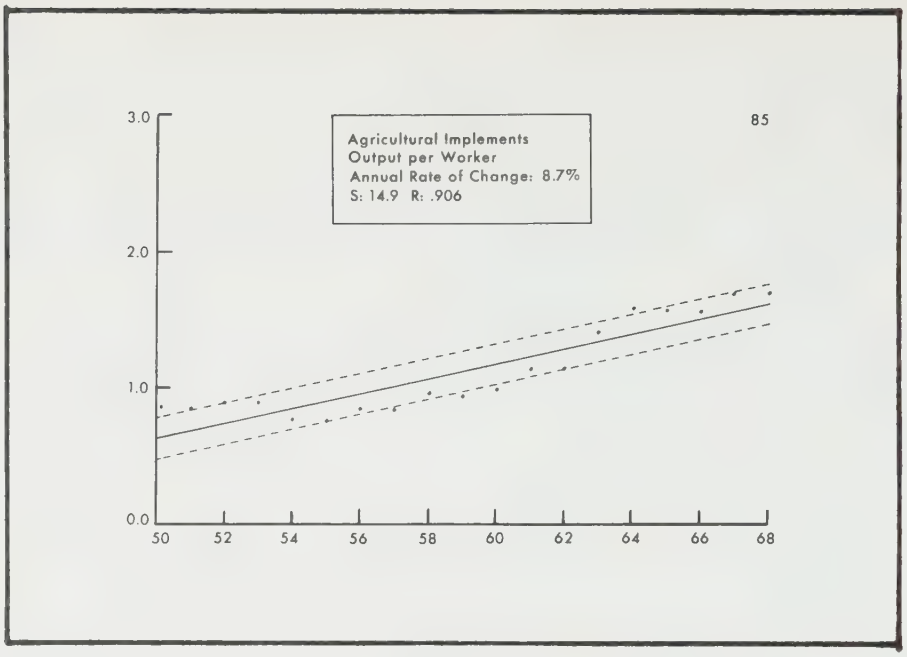
The agricultural implement industry (Standard Industrial Classification code 311) comprises establishments primarily engaged in manufacturing agricultural implements such as ploughs, threshing machines, binders, fertilizing machinery, milking machines, and mowing machines, also establishments primarily engaged in manufacturing tractors. There is no problem of statistical continuity for this industry under the old S.I.C. and the new classification introduced in 1960. Adjustments to the data published from 1960 on to establish continuity with earlier data are described in Appendix A.

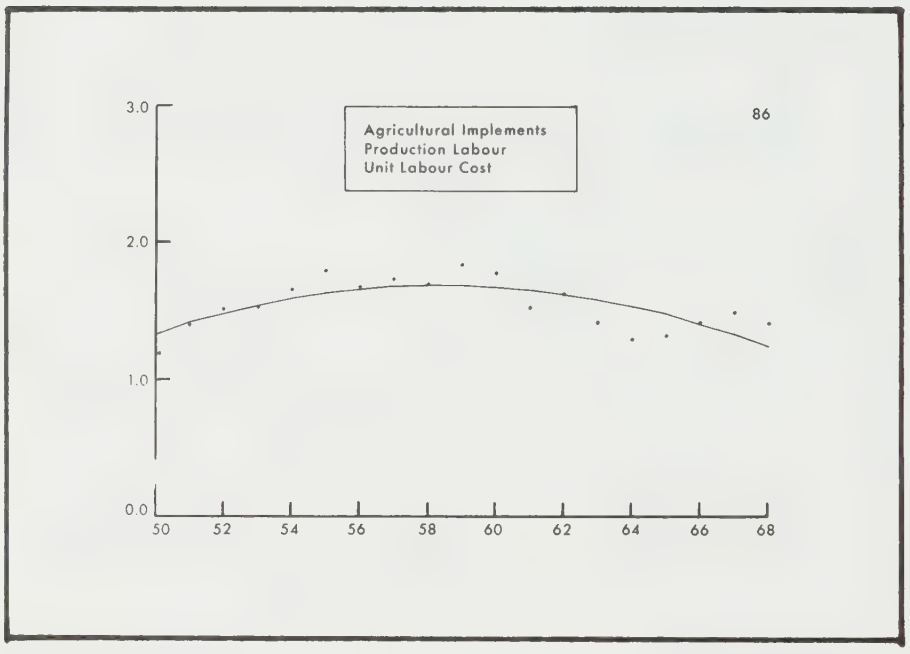
AGRICULTURAL IMPLEMENTS

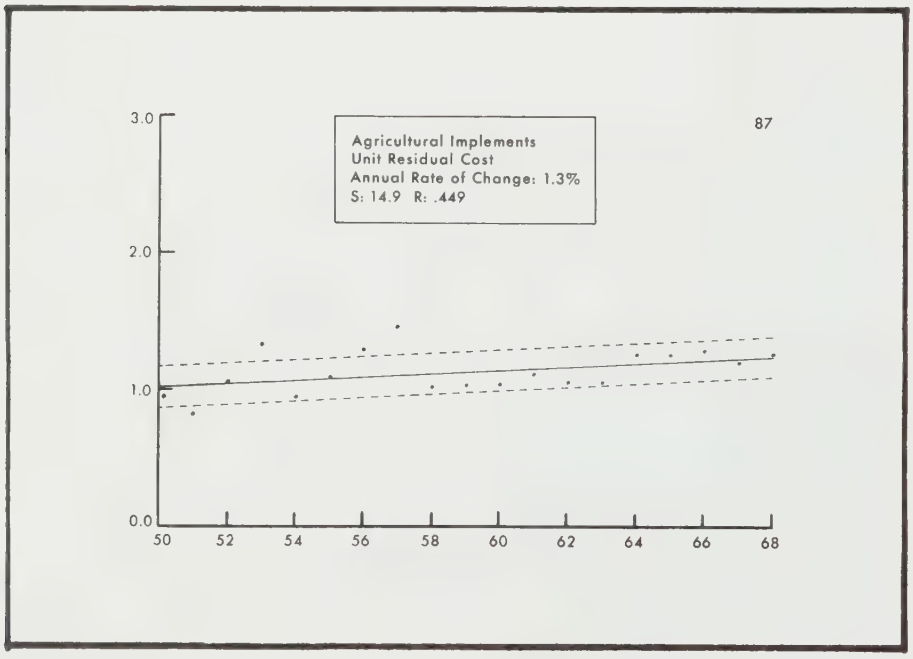
Summary Table — Principal Statistics

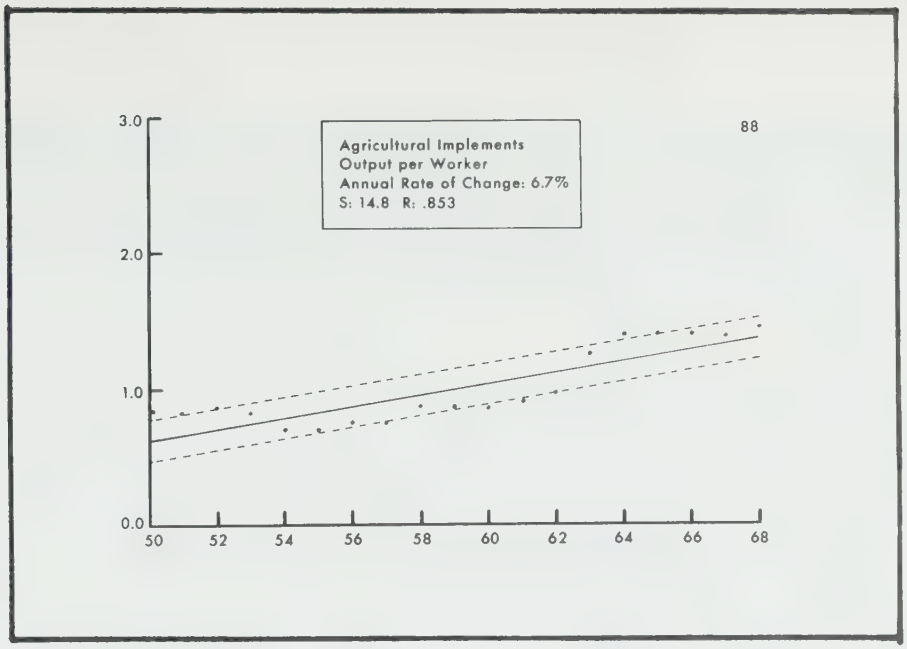
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			115.9			192.2			
Index of value added (1949 or 1961 = 100)			154.2			196.9		211.0	
Index of employment (1949 or 1961 = 100)	68.0	79.7		128.8	120.4				
Index of compensation per worker (1949 or 1961 = 100)	241.3	247.9		138.5	141.5				
Annual trend rate, compensation per worker	+7.1%	+7.4%		+5.5%	+5.1%				
Implicit, value-added price — index, 1949 or 1961 = 100			133.0			102.5		109.7	
— Annual trend rate of change			+0.4%			+1.0%		+0.8%	
— R value			.235			.647		.703	
Output per worker — index, 1949 or 1961 = 100	170.5	145.4		149.6	159.7				
— Annual trend rate of change	+8.7%	+6.7%		+6.2%	+5.4%				
— R value	.906	.853		.886	.792				
Unit labour cost — index, 1949 or 1961 = 100	141.5	170.5		92.6	88.6				
— Annual trend rate of change	−0.3%	+0.5%		−0.8%	−0.8%				
— R value	.153	.191		.256	.192				
Unit residual cost — index, 1949 or 1961 = 100	126.5	85 7		112.8	167.7		214.2		
— Annual trend rate of change	+1.3%	+0.2%		+2.5%	+2.9%		+4.4%		
— R value	.449	.159		.759	.670		.493		
Payroll as a proportion of value added 1949	43.9%	55.8%							
1961				51.6%	82.6%		83.0%		
1968	46.7%	71.5%					66.9%		
Trend rate of change in labour share	−0.7%	+0.1%		−1.9%	−1.7%		−1.6%		
— R value	.459	.064		.553	.458		.390		
Trend rate of change in residual share	+0.9%	−1.3%		+1.4%	+1.8%		+3.4%		

Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.


85
Agricultural Implements
Output per Worker
Annual Rate of Change: 8.7%
S: 14.9 R: .906
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


86
Agricultural Implements
Production Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


87
Agricultural Implements
Unit Residual Cost
Annual Rate of Change: 1.3%
S: 14.9 R: .449
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


88
Agricultural Implements
Output per Worker
Annual Rate of Change: 6.7%
S: 14.8 R: .853
3.0
2.0
1.0
0.0
50
52
54
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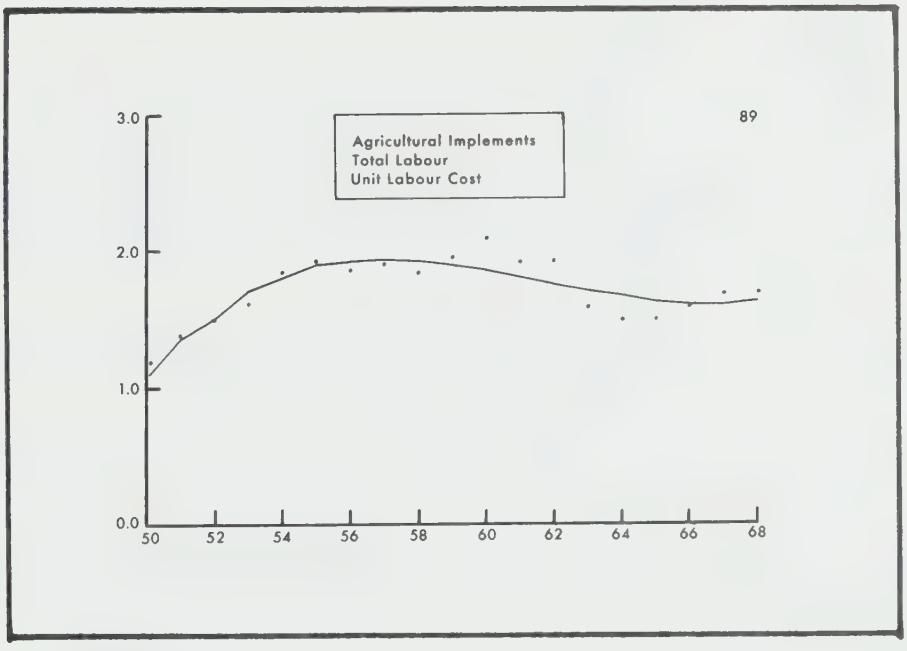
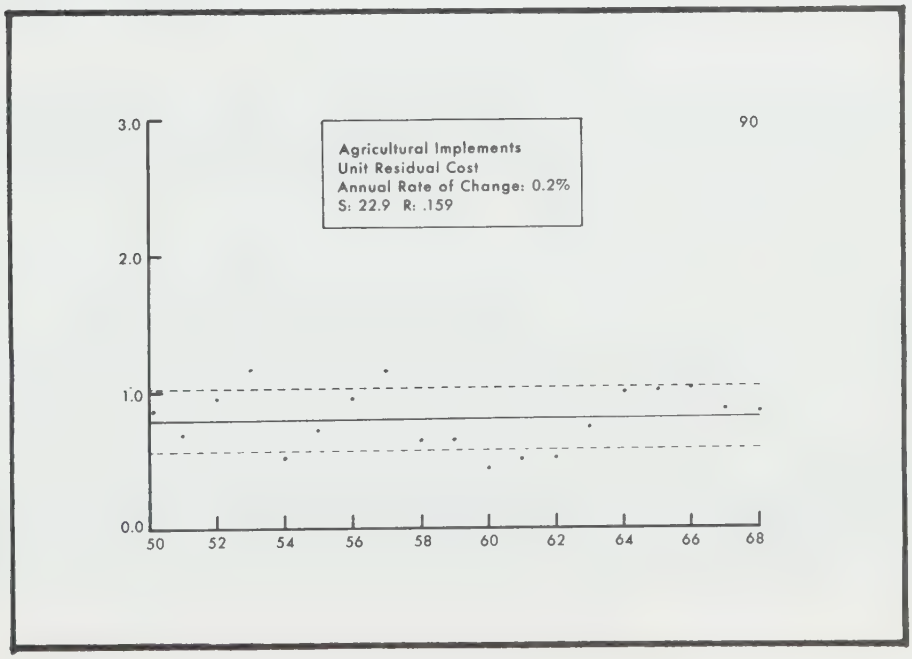
66
68


89
Agricultural Implements
Total Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


90
Agricultural Implements
Unit Residual Cost
Annual Rate of Change: 0.2%
S: 22.9 R: .159
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68

An important characteristic of this industry that makes it difficult to discern any long-term and sometimes even short-term trends is its very great fluctuations in economic activity. In the case of the implicit price and unit cost series the pattern seems to be more nonlinear than linear which renders of little value any discussion of annual trends. This is considered further when these series are analyzed. The instability of economic movements is illustrated by the year-to-year changes in production; the following percentages are derived from data on production in Table 2:

1949–50	–17.7%
1950–51	+ 4.0
1951–52	+10.3
1952–53	–25.1
1953–54	–30.0
1954–55	– 0.4
1955–56	– 9.5
1956–57	+ 4.7
1957–58	+24.6
1958–59	+22.5
1959–60	–17.3
1960–61	+ 2.2
1961–62	+ 5.3
1962–63	+45.0
1963–64	+24.6
1964–65	+10.0
1965–66	+ 6.3
1966–67	– 1.3
1967–68	–12.5

This is why production in 1968 was only 15.9 percent greater than in 1949, compared with 170.6 percent in all manufacturing, but 92.2 percent greater than in 1961, compared with 61.1 percent in all manufacturing. The year of greatest increase over 1949 was 1966 when it was 34.3 percent, whereas in 1956 production was 55.4 percent below the 1949 level. Measured from the 1956 low to the 1966 high, there was a 300 percent increase.

Value added displayed similar variations. While the increase between 1949 and 1968 was 54.2 percent, the greatest increase over 1949, as with production, was in 1966, when it was 80.1 percent. The low point was reached in 1954 when it was 37.9 percent below 1949. The increase between 1954 and 1966 was 190 percent.

Employment also fluctuated greatly but a long-term decline seems evident for both production and total labour. Between 1949 and 1968 production worker employment declined 32.0 percent and total employment, 20.3 percent, compared with increases of 27.2 and 32.8 percent respectively in all manufacturing. The low point for both categories of employment was reached in 1956 when production worker employment was 47.5 percent below the 1949 level and total employment 40.7 percent below (see Table 3). For both groups the high point was 1952 with increases of 6.4 and 8.8 percent over 1949 for production worker and total employment respectively. Between 1952 and 1956 the employment of production labour fell off 51 percent and the drop for total labour was 45 percent. There were upward and downward movements in employment between 1956 and 1968 but the increase between these years was 29.5 percent for production labour and 34.4 percent for total labour. The increases between 1961 and 1968 of 8.3 and 20.4 percent for production and for total labour respectively compare with 19.7 and 29.8 percent for all manufacturing. With respect to the two measures of employment, only one industry in each case showed a greater reduction in employment between 1949 and 1968.

Over the full period there was a rather substantial decline in the proportion of production labour to total employment. It moved from 83.5 percent in 1949 to 71.2 percent in 1968, a reduction of 14.7 percent. The annual trend rate of decline was ·0.7 percent (statistically significant with R = .77; see Table 5). The industry moved from having a slightly higher than average production worker proportion in 1949 (83.5 percent compared with 81.1 percent) to a significantly lower proportion in 1968 (71.2 percent compared with 77.7 percent).

Compensation (annual wages, annual wages and salaries) per worker increased less than average for both production and total labour over both the full and short periods, but over the full period the difference was not great. Over the full period compensation per production worker increased 141.3 percent, 12 1/2 percent less than the 161.5 percent for all manufacturing; the annual trend rate of increase was 7.1 percent, slightly less than the 7.2 percent for all manufacturing. Over the short period the increase was 38.5 percent, about 12 1/2 percent less than the 43.9 percent for all manufacturing; the annual trend rate of increase was 5.5 percent, about 13 percent below the rate of 6.3 percent for all manufacturing.

Annual wages per production worker increased less than average hourly earnings which in turn increased less than occupational wage rates, between 1949 and 1968 (see Table 9A). The increases were, respectively, 141.3, 160.8 and 168.8 percent. Between 1961 and 1968 average hourly earnings fell slightly behind annual wages; the increases were 38.5, 36.3 and 45.5 percent. Layoffs and time lost by strike activity can reduce annual earnings but not affect the other two measures, while

abnormally heavy overtime can raise average hourly earnings more than annual pay. (These factors are discussed further in Chapter Six.)

For total labour the increase in annual earnings per worker over the full period was 147.9 percent, 11 percent less than the 166.5 percent for all manufacturing. The annual trend rate of increase of 7.4 percent was a little higher than the 7.1 percent for production labour but slightly less than the 7.5 percent for all manufacturing. Over the short period the increase was 41.5 percent, slightly less than the 45.9 percent in all manufacturing, but the trend rate of 5.1 percent was 19 percent less than the rate of 6.3 percent in all manufacturing.

Over the full period there was no real trend, upwards or downwards, in implicit (value-added) price. This is because the computed annual trend rate of increase of 0.4 percent was so low as to mean a "no change" trend, that is, movement along a virtually horizontal line, and because the trend rate just mentioned was not statistically significant with the R (goodness of fit measure) having a value of only .235.[20] (Significance at the 95 percent level requires an R value of at least .388; see Appendix C.) Movements of implicit price through the 1950's were too irregular to indicate any direction, as can be seen from Table 12: an increase of 7.2 percent between 1949 and 1951, a jump of 17.0 percent the next year, followed by 12.5 percent, then a drop the next year of 11.1 percent, followed by three increases of 11.1, 4.5 and 8.0 percent successively, then a drop of 16.5 percent, followed by a rise of 5.3 percent, a drop of 1.4 percent, and between 1960 and 1961 a further reduction of 4.7 percent - all in all, eight increases and four decreases of greatly differing intensity. From 1961 to 1968 there were also rises and falls but of much smaller magnitude. While there was a difference of 57.5 percent between the highest and lowest values in the years from 1949 to 1960, the maximum difference in the 1961-1968 period was only 10.6 percent and there was a statistically significant trend.

Because of the lack of any trend over the full period, implicit (value-added) price is only examined for the short period. A further reason is the weak or nonexistent trends over the full period for both unit labour and unit residual cost, which, of course, explains the performance of implicit price. There was also no statistically significant linear trend for unit labour cost in the short period either with only unit residual cost showing a strong trend. However, there appears to be a significant but nonlinear pattern of change for most of these series which calls for more complex analysis than this study can offer. It means that the changes follow some kind of pattern related principally to variables that are not correlated with the passage of time. To attempt an analysis of such movements requires identifying and measuring these other variables, something quite beyond the terms of this study. (See Appendix C for a brief consideration of nonlinear functions in these series.)

Labour productivity (output per worker) did follow significant trends over both the full and short periods. Over the full period trends in output per worker were above average (as, indeed, they were over the short period as well) but the percentage increases between 1949 and 1968 were below average. This is because after sharp increases between 1960 and 1964, preceded by more gradual increases between 1954 and 1960 (which together explain the relatively high trend rates), there was a levelling off from 1964 to 1968, which explains the below average increases of 1968 over 1949. (All of this can be observed from the charts and from Table 17.)

Between 1949 and 1968 output per production worker rose 70.5 percent, 37 percent less than the 112.7 percent in all manufacturing. However, for reasons just given, the annual trend rate of increase was above average, 8.7 percent, almost 50 percent greater than the 5.9 percent in all manufacturing. However, nine of the industries studied had higher rates of increase (see Table 19). Between 1961 and 1968 the increase was 49.6 percent, more than 40 percent in excess of the 34.6 percent for all manufacturing; the annual trend rate of increase of 6.2 percent, while lower than the 8.7 percent for the full period, was two-thirds greater than the 3.7 percent for all manufacturing. Not only had the margin over all manufacturing widened, but only two of the industries studied had higher rates, compared with nine industries for the full period.

Increases with respect to total labour were somewhat less but still above average. Between 1949 and 1968 the increase was 45.4 percent, 56 percent less than the 103.7 percent for all manufacturing; but the annual trend rate of increase of 6.7 percent was 16 percent greater than the 5.8 percent for all manufacturing, but notably less than the 8.7 percent for production labour in this industry. Between 1961 and 1968 the increase was 59.7 percent, almost 2 1/2 times the increase of 24.1 percent for all manufacturing. The trend rate was 5.4 percent, less than the 6.7 percent for the full period and the 6.2 percent for production labour, but almost 40 percent greater than the 3.9 percent for all manufacturing. While 11 of the industries studied had higher rates of increase for the full period, there were only four such industries for the short period.

Unit labour cost, it has already been pointed out, followed a nonlinear pattern, which is illustrated in the charts; the regressions are set forth in Appendix C. Because the components of this pattern are more visible for the total labour measure of unit labour cost, this one is discussed, but much the same observations apply to the production labour measure as well.

It can be seen from the chart showing the curvilinear function for unit labour cost with respect to total labour, that for certain periods, separated from the whole, a linear trend is visibly apparent. However, when these trends are linked, the effect is a nonlinear movement. From 1949 to 1955 there was a steady upward movement amounting to 92.3 percent altogether (see Table 24), from 1955 to 1959 there was little change, from 1960 to 1964 there was a downward movement, amounting to 29 percent altogether, then one year of no change, and a rise of 13.7 percent between 1965 and 1968.

Unit residual cost did have a statistically significant trend over the short period and over the full period with respect to production labour but not total labour. However, while the full-period trend was statistically significant,[21] only 20 percent of the change could be associated in a linear fashion with the passage of time,[22] so that in effect it is not very significant for purposes of this study. Attention is therefore confined to unit residual cost over the short period.

Between 1961 and 1968 unit residual cost with respect to production labour increased 12.8 percent, more than twice the increase of 5.8 percent for all manufacturing (see Table 28). The annual trend rate of increase was 2.5 percent. Comparison with all manufacturing is meaningless because the trend rates for all manufacturing are not statistically significant. However, ten of the industries studied had higher rates of increase, while seven others had rates of decrease (see Table 31). With respect to total labour there was an increase between 1961 and 1968 of 67.7 percent, compared with a decrease of 1.2 percent for all manufacturing. The trend rate of increase was 2.9 percent per annum, somewhat higher than the 2.5 percent for the production labour measure, indicating that nonlabour costs were rising more than nonproduction labour costs which are included in the measure related to production labour but not in the measure related to total labour. Seven industries had higher rates of increase and one had the same rate, while five had rates of decrease. When this measure is related to value added, total activity rather than value added by manufacturing, the increase is even more pronounced.

It can come as no surprise that, with the lack of clear trends in implicit (value-added) price and most of its components, there should be an equally unclear trend in the labour share of value added. However, only in the case of total labour over the full period was there no significant trend. But even though the production labour share increased over 1949-1968 from 43.9 percent to 46.7 percent, there was an annual trend rate of decline of -0.7 percent. This is because the share was higher, at 51.6 percent, in 1961, then moved down to the lower value in 1968. The erratic movements of the labour shares in this industry can be observed from Table 34.

Agricultural implements was more labour intensive than average although the considerable fluctuations in this industry's labour share mean that its relation to the share in all manufacturing varied greatly. However, in 1968, the production labour share was 46.7 percent compared with 34.0 percent in all manufacturing, and the total labour share was 71.5 percent compared with 47.8 percent in all manufacturing.

The wide fluctuations in the labour share mean that current-weighted computations of change in the residual share are quite different from base-weighted computations. This is explained towards the end of the section on iron and steel mills and in parts of Chapters Three and Nine. Comparisons of the base-weighted and current-weighted computations may be obtained on request from the Canada Department of Labour, Economics and Research Branch.

It has already been pointed out that no clear trend in implicit (value-added) price was apparent for the full period so the composition of price change for agricultural implements is shown only for the recent period, as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1961-68[x]	(-0.8	x	.516)	+	(2.5	x	.484)	=	0.8	1.0
Tot. lab., 1961-68[x]	(-0.8	x	.826)	+	(2.9	x	.174)	=	-0.2	1.0
Tot. lab., 1961-68[y]	(-0.8	x	.830)	+	(4.4	x	.170)	=	0.1	0.8

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

The differences between the trend rates in columns A and B are so great in the case of the second and third equations that the validity of these equations must be questioned. (For a full explanation of the reason for the difference between the rates in the two columns, see the discussion immediately following the equations in the section of this chapter on slaughtering and meat processors.) The specific reasons in these cases are twofold: first, there is the absence of a clear linear trend in unit labour cost, which means that it cannot be clearly designated as a component of a linear trend in implicit price (which is explained in Appendix B); second, there is the fact that the weights assigned to unit labour cost are very high so that this measure is the major component of the equations. In some other industries already discussed one, but only one of the unit cost components of the equation represented a trend rate of little or no statistical significance, but the trend rate given was so small and/or the weight assigned to that component was so low that it had little influence on the result of the equation. However, in this case the trend rates lack statistical significance and carry a large weight. It must further be pointed out that the fluctuations in the labour share are greatly responsible for the differences between the column A and column B values here. The labour weights of .826 and .830 represent the total labour share of value added, manufacturing and value added,

total activity in 1961, which are much higher labour shares, as can be seen from Table 34, than for any of the following years. This fact, together with the wide fluctuations up and down from 1961 to 1968 in the labour share, help explain the discrepancy, and the fact that the production labour share follows a rather smoother downward trend helps explain the smaller discrepancy in the first equation.

In short, the unit cost measures are so erratic in their movements as to preclude any analysis of trends in implicit price change or its components. Analysis is possible of the particular change in implicit price and the components from one specified year to another and a precise weight can be given to each cost factor in its relation to implicit price change, but this analysis does not permit an application to other than the actual reference years.

About all that can be said is that over the 1961-1968 period there were significant upward trends in unit residual cost while unit labour cost moved fitfully, showing increases between some years and decreases between others. The participation of unit labour cost in implicit (value-added) price must be described as indecisive. (The word, "participation" is used in the sense of unit labour cost as a component of price change, not in a causal sense.)

Mention should be made of a study prepared for the Royal Commission on Farm Machinery on productivity in that industry.[23] The study covers the period, 1947 to 1966, but its estimates of productivity are not comparable with ours not only because of our use of revised data issued since completion of that study, but also because of a different methodology. The Royal Commission study uses deflated value added as the measure of output in which value added is deflated by the industry selling price index whereas our study uses the Statistics Canada data on real domestic product which is arrived at by a different method. (This is described in Chapter Four.) However, the interested reader will want to consult this other study because it contains much detailed data and examines some of the reasons for productivity change that are beyond the terms of reference of our study.

Motor vehicles

The importance of both exports and imports to this industry has changed greatly in recent years, partly because of the automotive trade agreement between Canada and the United States put into force in 1965, and partly because of a shift in consumer preference for the smaller car, which is typical of the kind imported from Europe or Japan. The statistics on exports and imports for this industry for 1965 appearing in Table 1 do not reflect the pattern of trade in more recent years. However, it can be said, without benefit of statistical support, that this industry has become most important to our export trade, while import competition is a significant element in the domestic consumer market. Its importance to the consumer is demonstrated by the fact that 5.1 percent of the consumer price index is related to automobile purchase.

The motor vehicles industry, for purposes of this study, consists of motor vehicle manufacturers (Standard Industrial Classification code 323) comprising establishments primarily engaged in manufacturing or assembling complete motor vehicles such as passenger automobiles, commercial cars and buses, trucks, ambulances, and taxicabs; and truck body and trailer manufacturers (S.I.C. code 325) comprising establishments primarily engaged in manufacturing truck and bus bodies but not complete trucks or buses, including the manufacture of truck trailers, tractor-type bus trailers and passenger car trailers. The new S.I.C., introduced in 1960, separated the activities of the industry into these two groups that, under the previous classification, comprised the motor vehicles industry. There are no problems of statistical continuity between the old and new series, although certain adjustments to the data are required in order to maintain continuity (see Appendix A).

The first thing to be said about this industry is that the introduction of the automotive parts trade agreement caused such enormous changes in production and trade with consequent effects on productivity and unit costs of production that the 1961-1968 period must be considered as so different from the earlier period that to examine the entire 1949-1968 as one unit of time is almost meaningless.

The very great difference between the 1950's and the 1960's is illustrated by the fact that while production in 1961 was 47.4 percent higher than in 1949, in 1968 it was 245.5 percent higher than in 1961 (see Table 2). In the 1950's production reached a peak in 1956 when it was 81.1 percent above the 1949 level but this is a modest rise compared with what happened in the 1960's. While there were some reductions in output from one year to another in the 1950's, the direction was consistently upward after 1961 with only two pauses:

1961-62	+13.2%
1962-63	+29.6
1963-64	+ 7.8
1964-65	+35.7
1965-66	+ 5.1
1966-67	+32.9
1967-68	+15.2

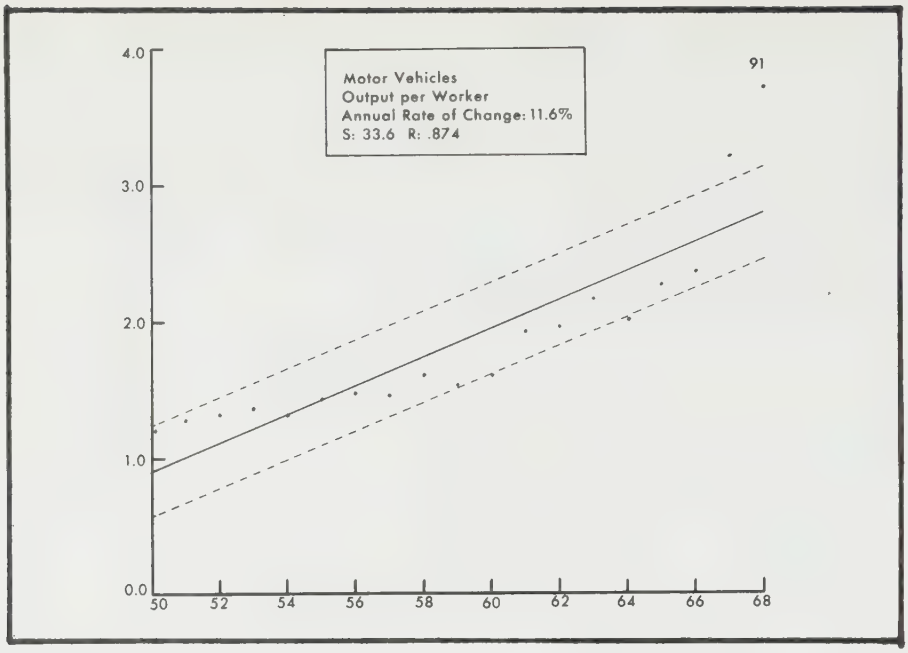
The increase in production between 1961 and 1968 of 245.5 percent was four times the increase of 61.1 percent for all manufacturing and by far the largest increase for any of the industries studied.

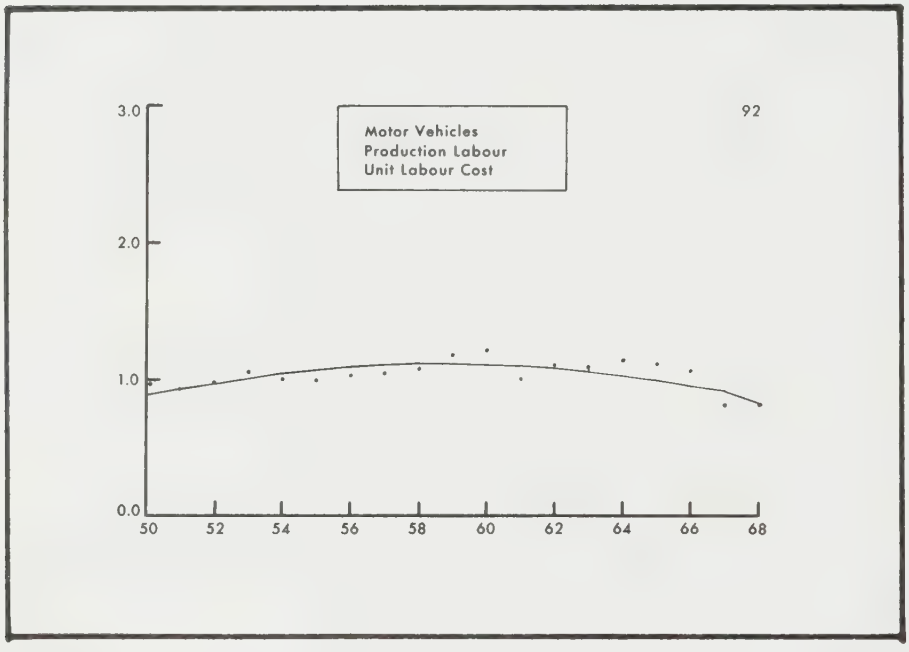
MOTOR VEHICLES

Summary Table — Principal Statistics

	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			509.3			345.5			
Index of value added (1949 or 1961 = 100)			437.2			284.1		323.3	
Index of employment (1949 or 1961 = 100)	137.1	139.3		179.0	165.6				
Index of compensation per worker (1949 or 1961 = 100)	301.6	294.9		156.4	153.3				
Annual trend rate, compensation per worker	+9.5%	+9.0%		+5.5%	+5.9%				
Implicit, value-added price — index, 1949 or 1961 = 100			85.2			82.2		93.5	
— Annual trend rate of change			+0.6%			−5.0%		−2.9%	
— R value			.201			.977		.993	
Output per worker — index, 1949 or 1961 = 100	371.4	365.6		193.1	208.5				
— Annual trend rate of change	+11.6%	+11.9%		+16.2%	+17.7%				
— R value	.874	.850		.889	.907				
Unit labour cost — index, 1949 or 1961 = 100	81.2	80.7		81.0	73.5				
— Annual trend rate of change	−1.0%	−0.1%		−4.4%	−4.9%				
— R value	.012	.049		.808	.482				
Unit residual cost — index, 1949 or 1961 = 100	88.1	89.6		82.8	89.2		104.6		
— Annual trend rate of change	+1.0%	+1.2%		−5.3%	−5.1%		−1.8%		
— R value	.224	.249		.968	.952		.730		
Payroll as a proportion of value added 1949	32.2%	42.1%							
1961				31.0%	44.3%		35.5%		
1968	30.5%	39.6%					27.9%		
Trend rate of change in labour share	−0.8%	−0.8%		+0.6%	+0.1%		−2.6%		
— R value	.158	.310		.176	.046		.596		
Trend rate of change in residual share	+0.4%	+0.7%		−0.3%	−0.1%		+1.4%		

Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.


Motor Vehicles
Output per Worker
Annual Rate of Change: 11.6%
S: 33.6 R: .874
91
4.0
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Motor Vehicles
Production Labour
Unit Labour Cost
92
3.0
2.0
1.0
0.0
50
52
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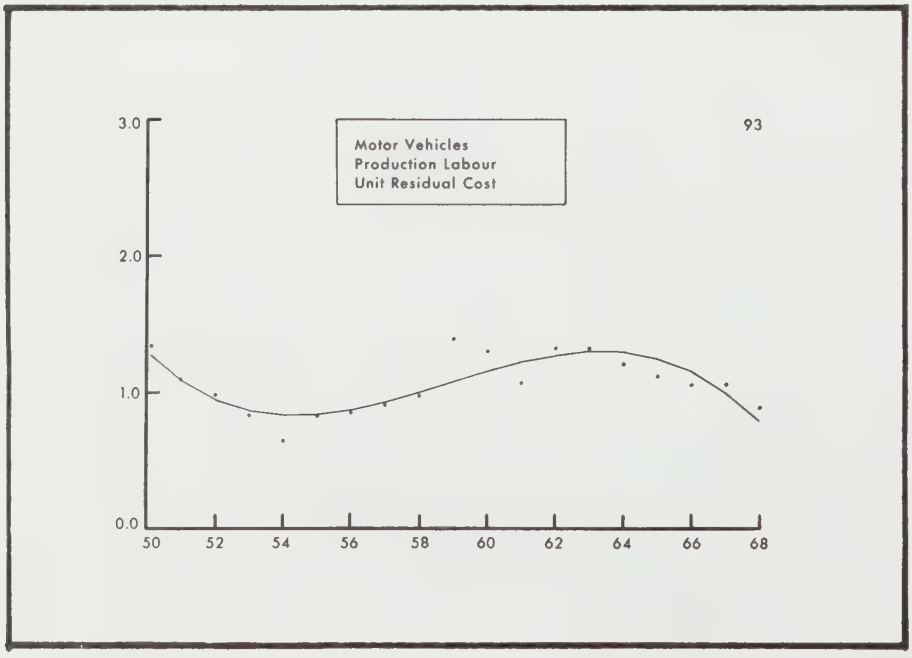
66
68


Motor Vehicles
Production Labour
Unit Residual Cost
93
3.0
2.0
1.0
0.0
50
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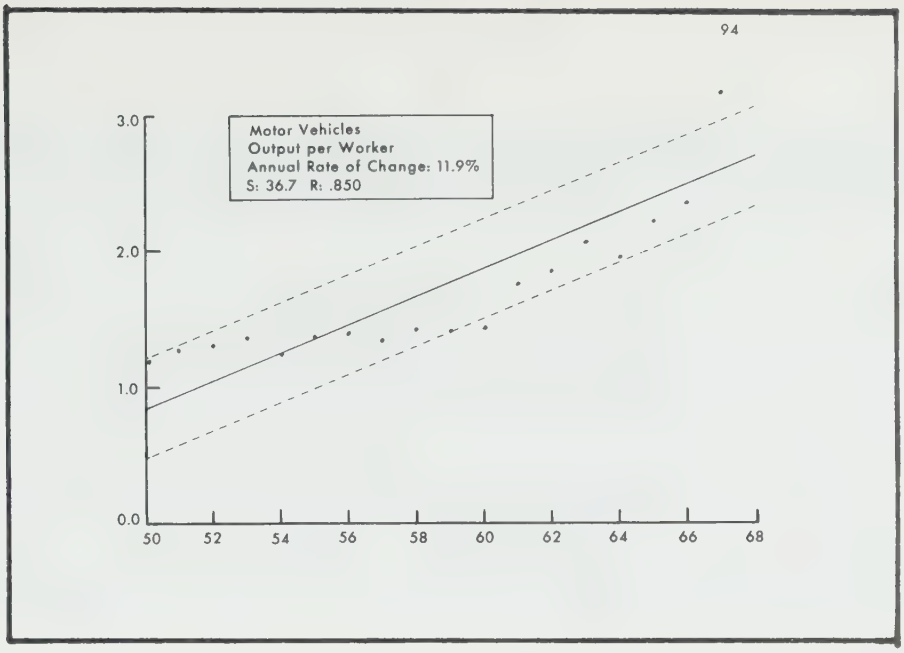
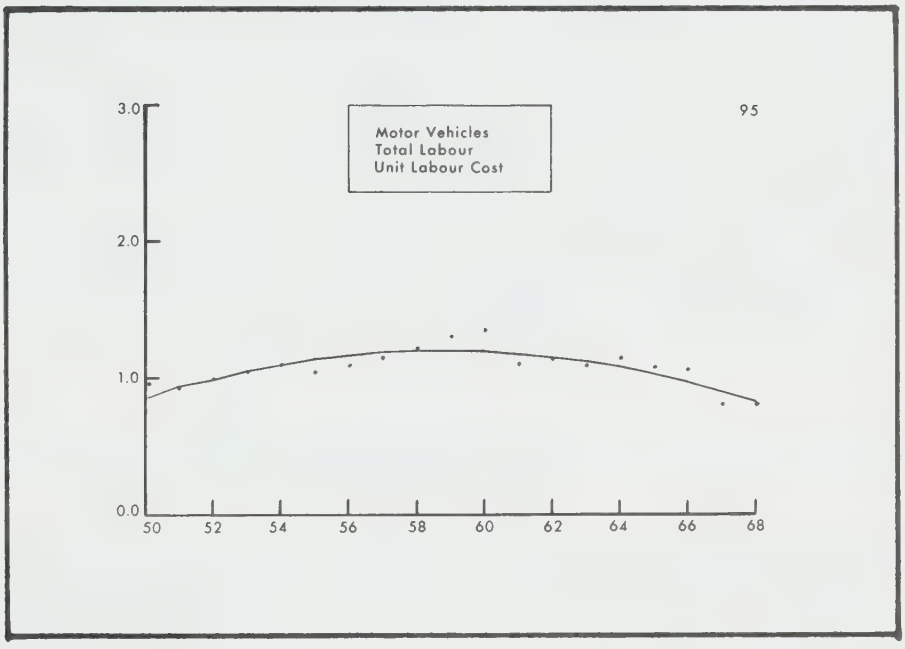
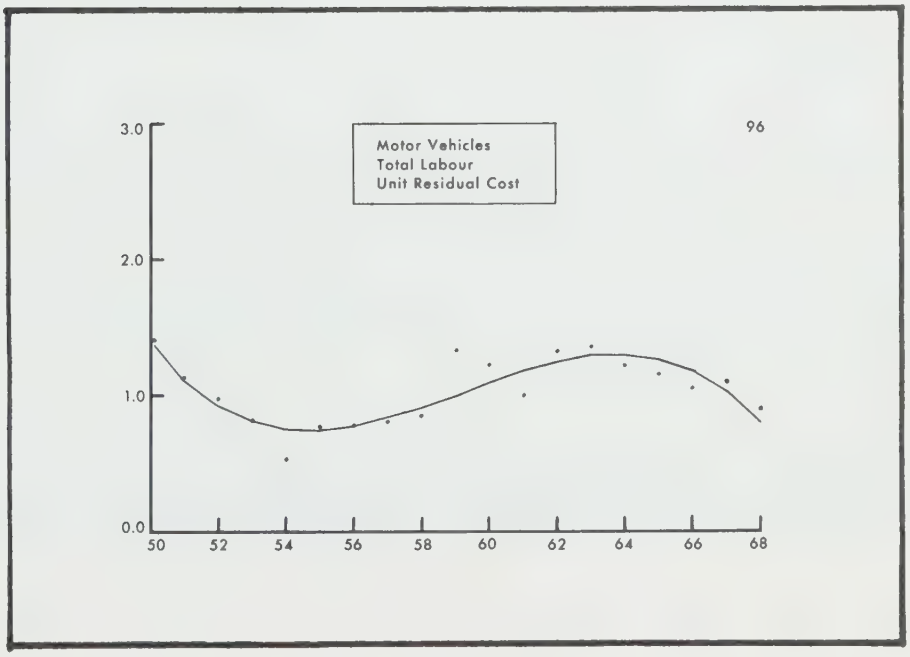

94
Motor Vehicles
Output per Worker
Annual Rate of Change: 11.9%
S: 36.7 R: .850
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


95
Motor Vehicles
Total Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


96
Motor Vehicles
Total Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

It follows that value added would also increase much more in the 1960's than the 1950's. Between 1949 and 1961 there was a rise of 53.9 percent but it was as high as 94.3 percent between 1949 and 1959; but between 1961 and 1968 the increase was 184.1 percent. This latter figure is not only more than 2 1/2 times the 71.0 percent increase for all manufacturing, but, as with production, much the highest for any of the industries studied. This also applies to value added, total activity where the 1961-1968 increase, at 223.3 percent, was even greater than that for value added, manufacturing.

As with other aspects of economic activity in this industry, employment moved erratically during the 1950's but followed a steady trend in the 1960's (see Table 3). Production worker employment moved up by 1956 to being 22.8 percent above the 1949 level and then moved downward until by 1961 it was 23.4 percent less than in 1949, and had declined by 38 percent from 1956. Between 1961 and 1968 employment steadily increased by 79.0 percent, almost four times that for all manufacturing, which was exceeded slightly in only one of the industries studied. Total labour employment followed similar fluctuations during the 1950's, reaching its low point in 1961, thereafter moving up to a peak in 1965 when it was 70 percent higher than in 1961, levelling off over the following years. The 65.6 percent increase between 1961 and 1968 was more than twice the increase of 29.8 percent in all manufacturing, exceeded by only one of the industries studied, which was motor vehicle parts and accessories, also affected by the automotive trade agreement.

There was no significant change in the proportion of production labour to total labour. The production worker proportion was 81.6 percent in 1949 and 80.4 percent in 1968, (see Table 5).

Compensation (annual wages, annual wages and salaries) per worker increased more than average for both production and for total labour over the full period and less than average over the short period. Between 1949 and 1968 for production labour the increase was 201.6 percent, 25 percent greater than the increase of 161.5 percent in all manufacturing; the annual trend rate of increase was 9.5 percent, about one-third more than the 7.2 percent in all manufacturing. Only one of the industries studied had a higher rate of increase over this full period and one other industry had a rate of almost the same magnitude (see Table 11). Between 1961 and 1968 the increase for production labour was 56.4 percent, 28 percent more than the increase of 43.9 percent for all manufacturing, but the annual trend rate of increase of 5.5 percent was 13 percent less than the average of 6.3 percent. The reason for the greater than average 1961-1968 increase in spite of a lower than average trend rate is partly a rise of 15.9 percent between 1967 and 1968 while most of the changes between other years were much smaller and two were decreases (see Table 9A). Layoffs and time lost because of strikes reduce annual wages while overtime work can increase them. Some of the jump between 1967 and 1968 appears to have been a consequence of greater overtime pay because average hourly earnings increased 12.6 percent, a little less than the 15.9 percent for annual wages, but much more than the 8.0 percent for wage rate increases which do not include overtime pay. However, 15 of the industries studied had higher rates of increase over this period for production labour, compared with only one over the full period (see Table 11).

Over the full period annual wages per production worker increased 201.6 percent, average hourly earnings, 166.4 percent, and wage rates 156.1 percent; over the short period the increases were 56.4, 47.9 and 45.3 percent (see Table 9A). Reasons for the difference in these increases have been suggested above, and are discussed further in Chapter Six.

For total labour annual compensation per worker increased over the full period at a slightly lower rate than for production labour, although still more than average, but over the short period its rate of increase was a little greater than for production labour but was lower than average. The increase between 1949 and 1968 was 194.9 percent, 17 percent more than the 166.5 percent for all manufacturing, and the annual trend rate of increase of 9.0 percent (compared with 9.5 percent for production labour only) was 20 percent greater than the 7.5 percent in all manufacturing. Three of the industries showed higher rates over this period. Between 1961 and 1968 the increase was 53.3 percent, 16 percent more than the 45.9 percent in all manufacturing; but because of relatively low increases in some of the years, the annual trend rate of increase was 5.9 percent, a little better than the 5.5 percent for production labour but rather less than the 6.3 percent in all manufacturing, while exceeded in nine of the other industries studied and matched in another.

As pointed out near the beginning of this section, changing circumstances of the industry made the 1960's so different from the 1950's as to render almost meaningless any analysis of the two decades as one time period. This is why the annual trend rate of change in implicit (value-added) price indicated for the full period lacks statistical significance ($R = .201$), while the trend rate for the short period is highly significant ($R = .977$). From 1962 to 1968 there was a steady decline (thus the higher significance), whereas over the earlier years, there was a substantial rise between 1949 and 1950, followed by a strong decline over the next four years, then a steady rise from 1955 to 1959, then another decline over the next two years (see Table 12). A glance at the unit cost data in the summary table of statistics shows that their trend rates over the full period have no statistical significance while those for the short period are of high significance. Therefore, discussion of implicit price and its cost components is confined to the 1961-1968 period.

Between 1961 and 1968 implicit price related to value added by manufacturing decreased by 17.8 percent, compared with an increase of 6.2 percent for all manufacturing (see Table 12). There was an annual trend rate of decrease of -5.0 percent, compared with a rate of increase of 0.9 percent for all manufacturing. Only four of the other industries studied showed falling implicit price over this period with respect to value added by manufacturing and none of the rates of decrease were as great as for this industry (see Table 16). Related to value added by total activity, implicit price did not decline quite

so much. There was a 6.5 percent reduction between 1961 and 1968, compared with an increase of 10.5 percent in all manufacturing, and the annual trend rate of decrease of -2.9 percent was almost half that for value added, manufacturing but compares with a rate of increase of 1.7 percent in all manufacturing. As with value added, manufacturing, only four of the other industries studied registered declines in implicit price over this period and none of them were as great as for this industry.

Between 1961 and 1968 the industry selling price index for motor vehicle manufacturers rose 1.8 percent, compared with reductions over the same period of 17.8 and 6.5 percent in the two indexes of implicit (value-added) price. The slight rise in the industry selling price, which is similar to a wholesale price, may have resulted from rising raw material or fuel and energy costs, which are reflected in industry selling but not implicit (value-added) price, or result from other costs at the factory or warehouse not included in value added. The consumer (retail) price index for a new passenger car was down 3.5 percent in 1968 from 1961.

Labour productivity (output per worker) increased moderately during the 1950's and at what must be described as an exceptionally high rate during the 1960's. It is not the purpose of this study to offer reasons for changes in productivity or any of the measures of economic activity examined here, but it can be said in this case that the remarkable increases for motor vehicles indicated in the charts and in Tables 17 and 19 are primarily related to the exceptional expansion of operations brought about by the automotive parts agreement between Canada and the United States.

The increases in output per worker between 1949 and 1961 were 92.3 and 75.3 percent for production and total labour respectively, 59 and 17 percent higher than the increases of 58.1 and 64.2 percent in all manufacturing (see Table 17). Between 1961 and 1968 the increases in this industry were 93.1 and 108.5 percent for production and total labour, which were almost 2 3/4 times and 4 1/2 times greater than the comparable increases of 34.6 and 24.1 percent in all manufacturing.

Because of the unusual performance of output per worker over this recent period in this industry, it is worthwhile to list the year-over-year changes during this time:

	With Respect to Production labour	Total labour
1961–62	+ 2.3%	+ 5.8%
1962–63	+ 9.6	+11.4
1963–64	- 6.9	- 5.3
1964–65	+13.1	+13.4
1965–66	+ 4.5	+ 5.9
1966–67	+35.1	+34.5
1967–68	+15.9	+15.7

The annual trend rate of increase in output per production worker was 11.6 percent for the full period, almost twice the rate of 5.9 percent for all manufacturing, but still exceeded by the rates in four of the other industries studied (see Table 19). Much of the rate for this industry reflects the large increases in 1964-65, 1966-67 and 1967-68, shown above; the rate for 1949-1961 (eliminating the influence of the later years) was 4.1 percent, [24] while the rate for 1961-1968 was 16.2 percent, almost four times greater than the rate for 1949-61, almost 4 1/2 times the short-period rate of 3.7 percent for all manufacturing, and by far the highest rate of increase for any of the industries studied.

For total labour the trend rate of increase over the full period was 11.9 percent per annum, for the 1949-61 period it was 8.9 percent, and for the 1961-68 period, 17.7 percent. The full-period rate of 11.9 percent was a little more than twice the 5.8 percent for all manufacturing and was exceeded by the rates for only three of the other industries studied (see Table 19), while the short-period (1961-1968) rate of 17.7 percent was 4 1/2 times the rate of 3.9 percent for all manufacturing and much the highest rate for any of the industries studied. Motor vehicles was one of the few manufacturing industries where labour productivity increased more in the 1960's than in the 1950's.

Unit labour cost followed a nonlinear rather than a linear trend over the full period (see Appendix C for the details), so that it is not amenable to analysis as a component of linear trend in implicit (value-added) price over this period. However, it did follow a significant linear trend over the short period, more so with respect to production labour ($R = .808$) than total labour ($R = .482$), but significant in both cases (at the 99 percent level in the first case and the 95 percent level in the second). (Charts accompany this section illustrating the nonlinear trend line for both classes of unit labour cost.)

In 1968 unit labour cost with respect to production labour was 19.0 percent below the 1961 level, whereas in all manufacturing there was an increase between these years of 6.9 percent (see Table 24). There was an annual trend rate of decrease of -4.4 percent, in contrast with a rate of increase of 2.0 percent in all manufacturing. Only two other industries among those studied showed rates of decrease and neither one was as great as for this industry (see Table 26). With respect

to total labour, the 1968 value was 26.5 percent below that for 1961, compared with an increase of 17.6 percent in all manufacturing. There was an annual trend rate of decrease of -4.9 percent while for all manufacturing there was a rate of increase of 1.9 percent. Four of the other industries studied had rates of decrease but the downtrend in this industry was by far the greatest.

Unit residual cost, like unit labour cost, followed a nonlinear path, as the charts reveal (see Appendix C for the details). Clearly, a linear trend rate over the full period would be without statistical significance, which is borne out by the low goodness of fit ratios (R = .224 and .249). However, also as with unit labour cost, only more so, there are strong, statistically significant trends for the three measures of unit residual cost over the short period.

Between 1961 and 1968 unit residual cost with respect to production labour decreased 17.2 percent, while for all manufacturing it increased 5.8 percent. The annual trend rate of decline was -5.3 percent, indicating a stronger downtrend in this measure than in unit labour cost relative to production labour. While six other industries among those studied showed rates of reduction (one of them lacking statistical significance), motor vehicles had the much greater negative rate (see Table 31). (A comparison with all manufacturing is not made since the trend rate for that industry lacks statistical significance.) With respect to total labour, there was a decline between 1961 and 1968 of 10.8 percent while there was a 1.2 percent drop for all manufacturing. There was an annual trend rate of decrease of -5.1 percent; five of the other industries studied showed negative rates, although in one case it was not statistically significant; one of them showed a slightly greater rate of decrease than motor vehicles.

Related to value added by total activity rather than by manufacturing, unit residual cost with respect to total labour behaved differently. Between 1961 and 1968 it increased 4.6 percent in contrast with reductions of 17.2 and 10.8 percent in the other two measures. While there was also a trend rate of decrease, it was not nearly as great, -1.8 percent, compared with -5.3 and -5.1 percent for the other two measures. Five other industries showed rates of decrease, four of them greater, while all manufacturing had a rate of increase of 1.6 percent per annum. (The all manufacturing rate in this case was highly significant statistically, which was not the case for the other two-short-period measures.)[25]

No statistically significant trends are discernible in movements of the labour share of value added, as can be seen from the low goodness of fit ratios (R values) in the summary table of statistics. Except, that is, for the labour share of value added by total activity which moved down from 35.5 percent in 1961 to 27.9 percent in 1968, following a statistically significant annual trend rate of decline of -2.6 percent. Twelve of the other industries studied showed downward trend rates for the labour share of value added, total activity, although a few of them were of doubtful statistical significance, but none of the negative rates were as great as for motor vehicles (see Table 36).

The production labour share of value added, manufacturing was 32.2 percent in 1949, 31.0 percent in 1961 and 30.5 percent in 1968. Reference to these years only would suggest some stability but the share was as low as 25.5 percent in 1950 and as high as 42.5 percent in 1954, suggesting instability, which is in fact a more accurate description (see Tables 34 and 38A), explaining the lack of a clear trend. Over the 20 years the share averages about one-third which would make it about the same as in all manufacturing.

The total labour share of value added, manufacturing was 42.1 percent in 1949, 44.3 percent in 1961, and 39.6 percent in 1968, its lowest value was 33.2 percent in 1950 and its highest, 60.1 percent in 1954. There was the same instability as in the production labour share (see Tables 34 and 38B). Averaged over the 20 years the share was 43.4 percent, a little less than the 47.4 percent for all manufacturing.

While the labour share was unstable, the fluctuations were not so great as to cause much difference between base-weighted and current-weighted computations of unit residual cost or change in the residual share, which are derived from formulas using the labour share as the weight. This is explained towards the end of the section on iron and steel mills in this chapter and in parts of Chapters Three and Nine. A comparison of the computations may be obtained on request from the Canada Department of Labour, Economics and Research Branch.

Because no trend is apparent in implicit (value-added) price over the full period, the composition of implicit price change for the motor vehicles industry is given only for the recent period, as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1961-68[x]	(-4.4	x	.310)	+	(-5.3	x	.690)	=	-5.0	-5.0
Tot. lab., 1961-68[x]	(-4.9	x	.443)	+	(-5.1	x	.557)	=	-5.0	-5.0
Tot. lab., 1961-68[y]	(-4.9	x	.355)	+	(-1.8	x	.645)	=	-2.9	-2.9

x – related to value added manufacturing
y – related to value added total activity
A – as calculated from this equation
B – as calculated by computer (see Table 16)

The fact that the values are the same in columns A and B indicates the goodness of fit of the unit cost trend rates in these equations. The major component of implicit price change was in each case unit residual cost. While both unit cost measures were moving down, in the first two equations, unit residual cost was moving down somewhat more than unit labour cost such that if unit labour cost had declined at the same rate, implicit price would have moved down by 5.3 percent per annum in the first equation and 5.1 percent in the second; however, the differences are quite small, six percent in the first case, two percent in the second. Of course, these differences would be greater if the labour weight were larger and the residual weight smaller, assuming no change in the trend rates. In the final equation related to value added by total activity, unit labour cost shows a downward trend rate that is about 2 3/4 times that for unit residual cost. If the latter had shown the same rate of change downward, implicit price would have declined by 4.9 percent per annum rather than 2.9 percent, a difference of forty percent.

Motor vehicle parts and accessories

The automotive parts trade agreement, effected between Canada and the United States, has had an impact on both exports and imports in this industry, as it has on the motor vehicles industry, just discussed. For this reason, the data on exports and imports in Table 1 for 1965, especially compiled for this study, probably do not reflect the more recent situation. Be that as it may, some parts of this industry have found exports an important part of their market while some parts have had to contend with import competition; indeed, some may fall into both categories.

Motor vehicle parts and accessories manufacturers (Standard Industrial Classification code 325) comprise establishments primarily engaged in manufacturing motor vehicle parts (except truck and bus bodies) such as engines, brakes, clutches, axles, gears, transmissions, wheels, frames, radiators, springs, automobile hardware, heaters, horns, and mirrors; excluding tires and tubes, automobile glass and batteries, which are classified elsewhere. Although revisions to the Standard Industrial Classification, introduced in 1960, were such that essential continuity of data under the old and new codes is possible, one large establishment was, under the new code, brought into this industry. However, that change and other revisions which have been discussed in Chapter Four are allowed for by the adjustments described in Appendix A.

This industry provides much of its output directly to the motor vehicles manufacturer but some is supplied directly to the consumer either through a retail outlet or as parts used in shops where passenger cars and other vehicles are repaired. Fender repair, brake relining and muffler replacement account for 0.6 percent of the consumer price index; they have been selected as "proxies" for the cost of automobile repairs. Of course, the labour and other costs incurred by the repair shops contribute to the charges levied on the customer for their services, but the price of the parts themselves is obviously an important element.

Between 1949 and 1968 production in this industry increased 255.3 percent, 50 percent more than the increase of 170.6 percent for all manufacturing, but six of the other industries studied showed greater increases over this full period (see Table 2). In fact, between 1949 and 1961 the increase was only 38.8 percent, more than 40 percent less than the 68.0 percent for all manufacturing. It follows that all of the above average rise in output occurred in the 1960's. Between 1961 and 1968 the increase was 156.0 percent, 2 1/2 times more than the 61.1 percent for all manufacturing, and exceeded by only one of the industries studied, motor vehicles, which is the other industry to be most affected by the automotive parts agreement. However, the agreement's influence must not be exaggerated because the biggest year-over-year increase in this 1961-1968 period took place between 1961 and 1962 and there was, indeed, a slight drop in production between 1966 and 1967, after the agreement had come into effect. On the other hand, the second largest increase occurred between 1967 and 1968 and it was about four times the increase for all manufacturing, suggesting that a special factor, such as the agreement, had a bearing on this industry.

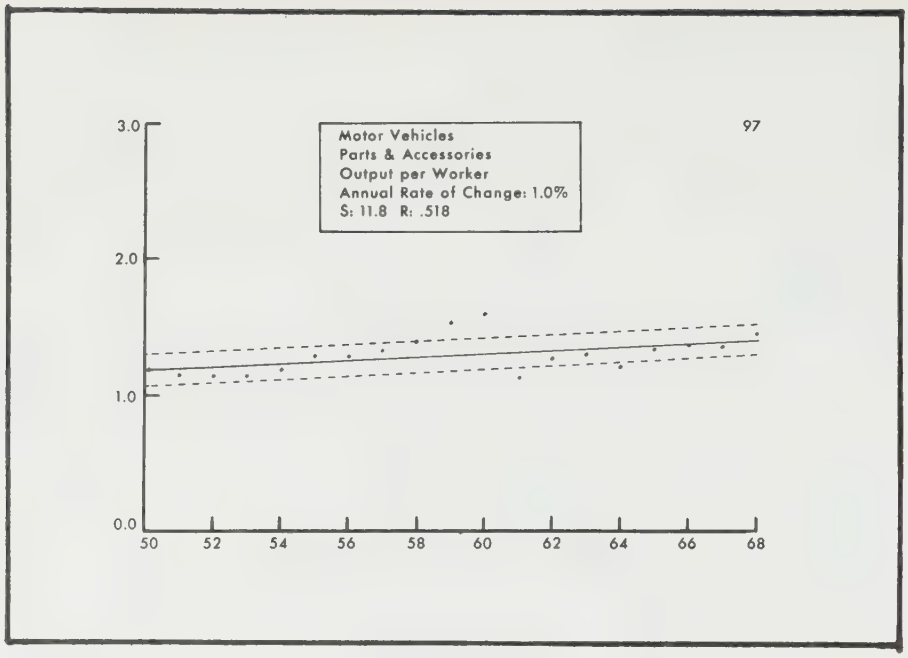
Value added increased not only more than average but not one of the industries studied registered a larger increase over the full or short period. This is not only because of the extraordinary increase in production over the short period but also because of the highest increase for any of the industries studied in implicit (value-added) price over the full period and one of the highest increases over the short period. This is discussed in more detail later in this section.

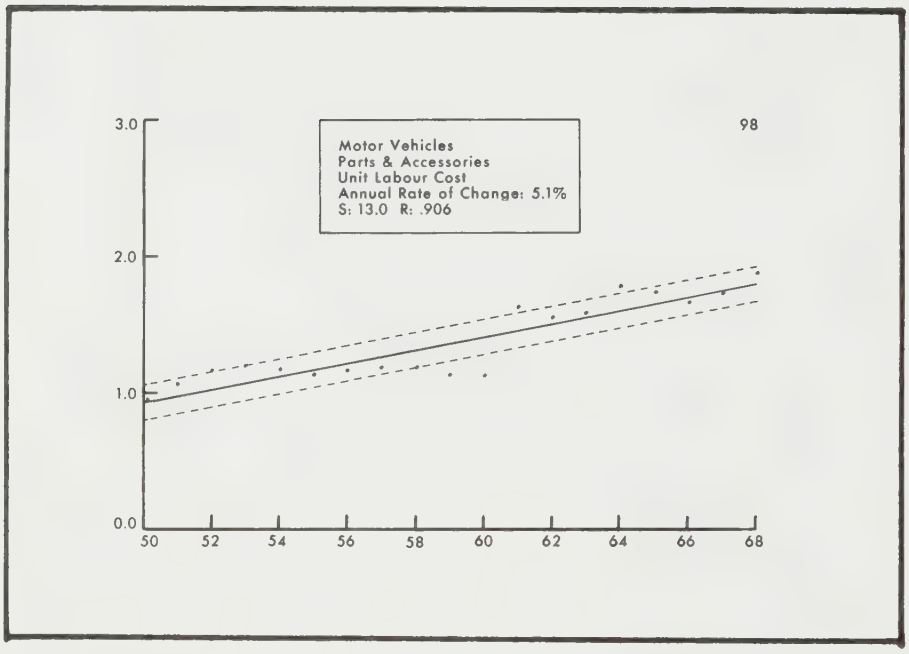
This industry experienced greater increases in employment over both the full and short periods than any of the industries covered by this study. The increases were somewhat larger for total labour than production labour alone, but this was the pattern in all manufacturing as well. Production labour employment in 1968 was 144.5 percent greater than in 1949, 5.3 times the increase of 27.2 percent for all manufacturing, and, it was 83.3 percent greater than in 1961, 4.2 times the increase of 19.7 percent for all manufacturing (see Table 3). For total labour, the 1968 figure was 162.1 percent greater than that for 1949, almost five times the all manufacturing increase of 32.8 percent, and the increase over 1961 was 91.5 percent, three times the rise of 29.8 percent for all manufacturing.

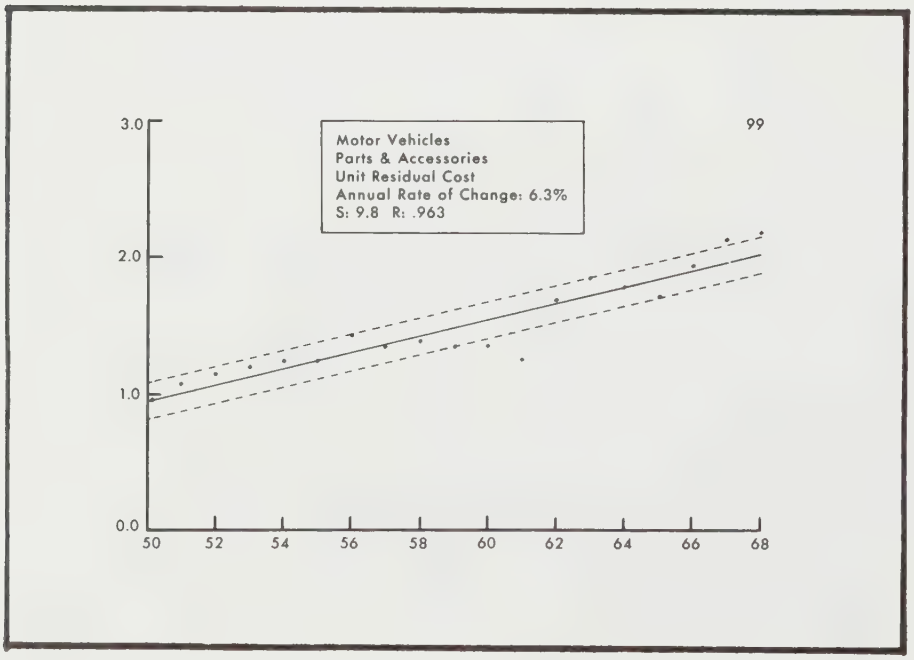
Summary Table – Principal Statistics

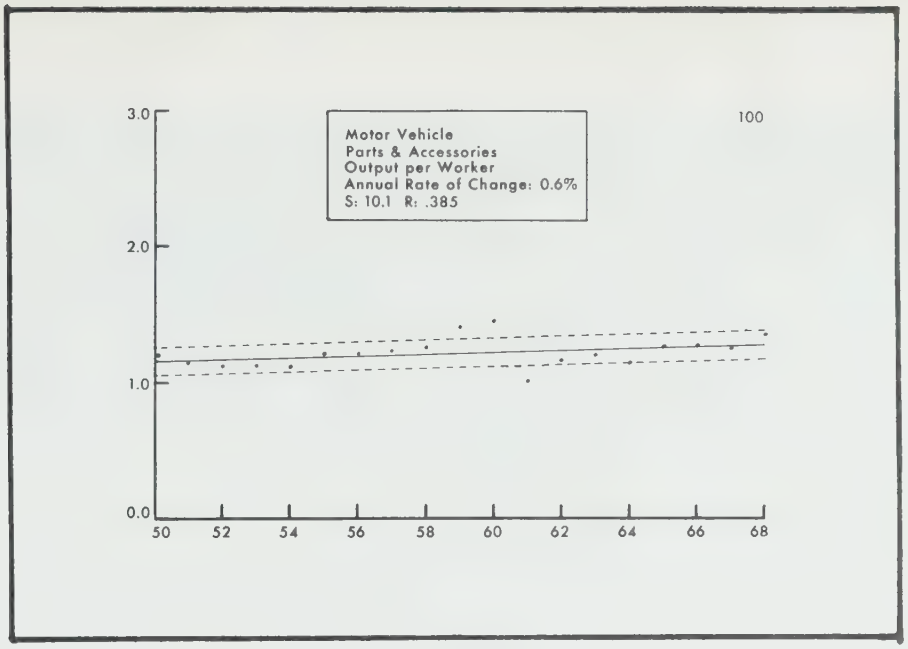
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			355.3			256.0			
Index of value added (1949 or 1961 = 100)			726.3			323.1		320.5	
Index of employment (1949 or 1961 = 100)	244.5	262.1		183.3	191.5				
Index of compensation per worker (1949 or 1961 = 100)	272.8	272.8		147.3	143.2				
Annual trend rate, compensation per worker	+7.3%	+7.4%		+5.2%	+5.1%				
Implicit, value-added price – index, 1949 or 1961 = 100			204.4			126.2		125.1	
– Annual trend rate of change			+5.8%			+3.8%		+3.7%	
– R value			.952			.934		.935	
Output per worker – index, 1949 or 1961 = 100	145.3	135.6		128.3	133.6				
– Annual trend rate of change	+1.0%	+0.6%		+2.3%	+2.6%				
– R value	.518	.385		.815	.874				
Unit labour cost – index, 1949 or 1961 = 100	187.6	201.2		114.7	107.2				
– Annual trend rate of change	+5.1%	+5.9%		+2.4%	+2.2%				
– R value	.906	.931		.759	.756				
Unit residual cost – index, 1949 or 1961 = 100	218.1	208.6		135.6	161.7				
– Annual trend rate of change	+6.4%	+5.7%		+4.8%	+6.3%				
– R value	.963	.907		.872	.848				
Payroll as a proportion of value added 1949	45.1%	56.2%							
1961				45.5%	65.2%		73.1%		
1968	41.4%	55.4%					62.6%		
Trend rate of change in labour share	−0.3%	+0.2%		−1.0%	−1.3%		−1.2%		
– R value	.233	.122		.447	.586		.556		
Trend rate of change in residual share	+0.2%	−0.2%		+0.6%	+1.1%		+2.5%		

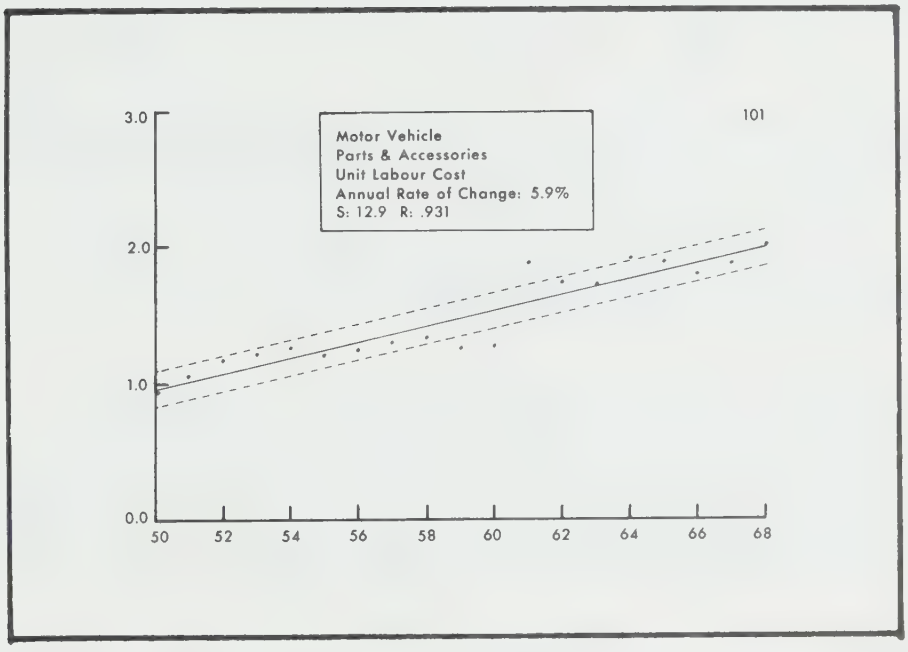
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

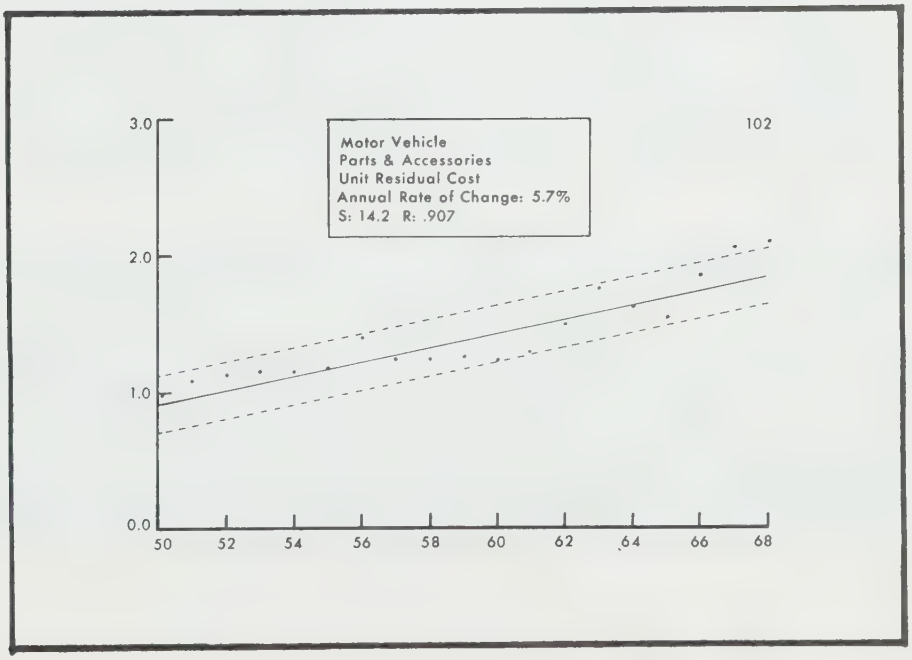

97
Motor Vehicles
Parts & Accessories
Output per Worker
Annual Rate of Change: 1.0%
S: 11.8 R: .518
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


98
Motor Vehicles
Parts & Accessories
Unit Labour Cost
Annual Rate of Change: 5.1%
S: 13.0 R: .906
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


99
Motor Vehicles
Parts & Accessories
Unit Residual Cost
Annual Rate of Change: 6.3%
S: 9.8 R: .963
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


100
Motor Vehicle
Parts & Accessories
Output per Worker
Annual Rate of Change: 0.6%
S: 10.1 R: .385
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


101
Motor Vehicle
Parts & Accessories
Unit Labour Cost
Annual Rate of Change: 5.9%
S: 12.9 R: .931
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


102
Motor Vehicle
Parts & Accessories
Unit Residual Cost
Annual Rate of Change: 5.7%
S: 14.2 R: .907
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

In 1949 the proportion of production labour to total employment was 84.6 percent; it was 6.6 percent less in 1968, at 79.0 percent (see Table 5). There was a statistically significant rate of decrease in this proportion of -0.4 percent. However, the porportions remained close to the average for all manufacturing.

Compensation (annual wages, annual wages and salaries) per worker increased at about the average rate over the full period and less than average over the short period. Over both the full and short periods the accumulated increases for production labour were slightly above average, which was true also for total labour over the short but not the full period.

Between 1949 and 1968 compensation per production worker increased 172.8 percent, a little more than the increase of 161.5 percent for all manufacturing. The annual trend rate of increase of 7.3 percent was just a little more than the 7.2 percent for all manufacturing. While the annual trend rate of increase for the short period of 5.2 percent was 17 percent less than the rate of 6.3 percent for all manufacturing (four industries had lower rates; see Table 11), the increase of 47.3 percent between 1961 and 1968 was somewhat greater than the 43.9 percent for all manufacturing. This was because of a sudden jump between 1967 and 1968 of 16.2 percent, compared with only 7.8 percent in all manufacturing (see Table 9A).

Compensation per worker for the total labour force was 172.8 percent above its 1949 level (just the same as for production labour only), only a very little more than the 166.5 percent increase in all manufacturing. The annual trend rate of increase at 7.4 percent, was a very little less than the 7.5 percent for all manufacturing. Between 1961 and 1968 the increase of 43.2 percent was almost the same as the 45.9 percent for all manufacturing, but the annual trend rate of increase of 5.1 percent was almost one-fifth less than the rate of 6.3 percent for all manufacturing; only three industries studied had lower rates, while one had the same rate (see Table 11). The 1961-1968 increase was in line with the average because of an unusually large increase between 1967 and 1968, as with compensation for production labour only (see Table 9C).

Data on average hourly earnings in 1949 in this industry were not available on which a series could be indexed, so it is only possible to compare changes in annual wages with changes in wage rates (see Table 9A). From 1949 to 1961 both increased to the same extent, 85.2 and 86.3 percent, but between 1961 and 1968, annual wages increased 47.3 percent and wage rates somewhat less, at 38.3 percent. Reasons for these differences are suggested in general terms in the section on wages in Chapter Six.

Implicit (value-added) price, it has already been pointed out, increased at a higher rate over the full period than for any of the other industries studied and at one of the highest rates of all over the short period with respect to both value added by manufacturing and value added by total activity.

Between 1949 and 1968 there was an increase of 104.4 percent, more than three times the increase of 33.0 percent in all manufacturing (see Table 12). The annual trend rate of increase of 5.8 percent was almost six times the average rate of 1.0 percent and as mentioned before, the highest rate computed. Between 1961 and 1968 the increase was 26.2 percent, about 4 1/4 times the increase of 6.2 percent for all manufacturing, while the trend rate was 3.8 percent, also 4 1/4 times the average. Four of the industries studied had higher rates of increase over this period. A similar comparison applies to value added by total activity over the short period. All the trend rates are highly significant statistically (each R value is greater than 0.9), and since the unit cost trend values are also statistically significant, meaningful equations can be presented showing the cost components of implicit price change over both the full and short periods.

The industry selling price index for this industry increased 7.9 percent between 1961 and 1968, compared with increases of 26.2 and 25.1 percent respectively in implicit price related to value added, manufacturing and value added, total activity. This much smaller increase in what is similar to wholesale price suggests that some of the higher implicit price was offset by the lower raw material or fuel and energy costs, which are reflected in the industry selling or wholesale prices but not in value added price. The increases in the consumer (retail) price indexes for fender replacement and brake relining were 41.3 and 28.4 percent. As pointed out previously, the indexes measure the total charge to the consumer, including labour and other charges set by the repair shop, as well as the cost of the parts themselves. However, it is worth noting that these increases are either greater than or equal to those of implicit (value-added) price and much greater than those for industry selling price. As elsewhere in this study, such discrepancies are pointed out but not explained.

Labour productivity (i.e. output per worker) increased much less than average over the full period and less than average over the short period in spite of the sharp increases in production. This is not surprising in view of the much above average increases in employment that accompanied the rising production.

Between 1949 and 1968 output per production worker increased 45.3 percent, which was 60 percent less than the increase of 112.7 percent for all manufacturing. Much of the lag behind the average resulted from the very sharp drop between 1960 and 1961, from 160.1 to 113.3, a reduction of 29.2 percent.[26] This would also partly explain why, over the full period the annual trend rate of increase of 1.0 percent was only about one-sixth of the 5.9 percent rate for all manufacturing and the lowest rate shown for this period for any of the industries studied (see Table 19). Production worker productivity improved over the short-period;[27] the increase between 1961 and 1968 was 28.3 percent, about one-fifth less than the increase of 34.6 percent for all manufacturing. The annual trend rate of increase, at 2.3 percent, was about 40 percent below the rate of 3.7 percent for all manufacturing, but six other industries had lower rates (see Table 19).

With respect to total labour, the performance of output per worker was much the same although its rate of increase over the recent period was somewhat greater. Between 1949 and 1968 there was an increase of 35.6 percent, little more than one-third of the 103.7 percent for all manufacturing; the annual trend rate of increase of 0.6 percent was only about one-tenth the rate of 5.8 percent for all manufacturing and the lowest rate for any of the industries studied. However, it must be emphasized that the effect of the substantial drop between 1960 and 1961, similar to that described above with respect to production labour, must be kept in mind.[28] As with production labour, there was a notable improvement over the short period but it was still below average. In fact, the increase between 1961 and 1968, at 33.6 percent, was significantly higher than the 24.1 percent for all manufacturing, but the annual trend rate of increase of 2.6 percent was one-third less. This is because there was an increase for all manufacturing in every year but the first (that is, 1961-1962), while there were decreases for two years for motor vehicle parts and accessories, and because while some of the increases in this industry were much larger than any for all manufacturing, their effect on the trend rate was largely offset by the changes in the other years. In any event, over the short period, six other industries had lower rates of increase and one showed a rate of decline.

An examination of the two charts on output per worker in this industry reveals a gradual upward trend until 1960, followed by the break between 1960 and 1961 that has been discussed, and then another gradual upward trend until 1968. Indeed, when the two periods are examined independently of each other, and a nonlinear trend is computed, very good fits are obtained; for production labour, R values of .987 and .880 for 1949-1960 and 1961-1968 respectively, compared with only .518 for a linear trend for 1949-1968; and for total labour .968 and .925, compared with .385 (see Appendix C). The question is whether the break between the end of the one period and the beginning of the other is "real" (i.e., reflects what actually happened) or statistical (see footnote 26). In the smelting and refining industry, discussed in the section following this one, a substantial statistical revision did necessitate separating the two time periods almost completely. Examination of the charts on motor vehicle parts and accessories reveals, as would be expected, a similar break between 1960 and 1961, concerning which the comments just made also apply.

The sharp drop in output per worker between 1960 and 1961 caused an equally sharp rise in unit labour cost, relative to production labour and to total labour. Inspection of the charts and of the indexes in Table 24 shows that between 1949 and 1960 there were only moderate increases, 13.2 percent for production labour and 27.2 percent for total labour, compared with 33.3 and 24.2 percent for all manufacturing; between 1961 and 1968 the increases were 14.7 and 7.2 percent, compared with 6.9 and 17.6 percent for all manufacturing. However, an increase of 44.4 percent for production labour and 47.6 percent for total labour is indicated between 1960 and 1961 (to be compared with reductions of 29.8 and 29.2 percent in output per worker), so that between 1949 and 1968 unit labour cost increased 87.6 percent with respect to production labour only, compared with 23.0 percent in all manufacturing and, relative to total labour the increase was 101.2 percent, compared with 30.8 percent for all manufacturing.

The annual trend rate of change for unit production labour cost over the full period was 5.1 percent, which is ten times the rate of 0.5 percent for all manufacturing and the highest rate of increase for any of the industries studied (see Table 26). However, for the reasons stated, its significance is open to question.[29] For the short period the trend rate was 2.4 percent, one-fifth greater than the 2.0 percent for all manufacturing, and a rate that was exceeded in eight of the industries studied. With respect to total labour, the trend rate for the full period was 5.9 percent, which, as might be expected, was more than eight times the rate of 0.7 percent for all manufacturing and the largest shown for any industry. For the short period the rate was 2.2 percent, slightly less than the 2.4 percent for production labour, one-sixth greater than the 1.9 percent in all manufacturing, but exceeded in 11 of the industries studied.

For the reasons with which the reader is now familiar, data on unit residual cost over the full period must be questioned. Between 1960 and 1961, when the sudden change occurred, the measure related to production labour increased 18.5 percent but by a much more modest 4.4 percent when related to total labour (see Table 28). The increase of 18.5 percent, while large, is small in comparison with the changes in output per worker and unit labour cost and not such as to affect seriously the continuity of the series. Unit residual cost related to production labour in 1968 was 118.1 percent above its 1949 value and the difference was 108.6 percent with respect to total labour. These increases were much greater than the 38.9 and 35.1 percent increases for all manufacturing. Similar differences between this industry and all manufacturing were observed for unit labour cost.

The behaviour of unit labour cost over the short period was closer to that of all manufacturing. However, very high increases in implicit (value-added) price continued over the short as well as the full period; because of this and because over the short period unit labour cost increased more moderately than over the full period, unit residual cost increases had to be much above average. For the measure related to production labour there was an increase of 35.6 percent between 1961 and 1968 while for all manufacturing it was only 5.8 percent. The measure related to total labour, value added, manufacturing increased 61.7 percent while there was a small reduction of 1.2 percent in all manufacturing; with respect to total labour and value added, total activity, the increase was 74.2 percent, compared with 5.0 percent in all manufacturing.

Recognizing once more that the full-period rates are of questionable accuracy, it is to be observed that the annual trend rate of increase with respect to production labour was 6.4 percent, almost five times the rate for all manufacturing, and the highest rate shown for any of the industries studied (see Table 31). With respect to total labour, the rate over the full period

was 5.7 percent, 4 3/4 times the rate for all manufacturing, and, once again, the highest rate for any of the industries studied.

The trend rates for the short period (when the "break" in the data between 1960 and 1961 would have no effect) were somewhat less extreme but still much above average. With respect to production labour, the rate of increase was 4.8 percent, one of the highest, but exceeded, nevertheless in three other industries and matched in one. With respect to total labour and value added by manufacturing, the rate was 6.3 percent, and with respect to total labour and value added by total activity, the annual trend rate of increase was 6.9 percent, with only one industry having a higher rate.

There was no significant trend in the production worker or total labour share of value added over the full period. The change between 1960 and 1961 that has been discussed throughout this section contributed to the erratic appearance of the fluctuations. Between these years there was an 11.8 percent increase in the production labour share and 14.4 percent increase in the total labour share (see Table 34). But, aside from that special situation, the share showed little sign of a steady movement up or down.

The production labour share was 45.1 percent in 1949, 45.5 percent in 1961 and a little lower, at 41.4 percent in 1968; but values at least as high as 45 percent are also shown for 1952, 1953 and 1965. The total labour share was 56.2 percent in 1949, 65.2 percent in 1961 and 55.4 percent in 1968, but for the reasons given, the 1961 share must be regarded as not only unusual but questionable. Ignoring this 1961 figure, it can be seen (Table 34) that there has been little net change over the years. The same can be said concerning the total labour share of value added by total activity.

This industry was more labour intensive than average over the 1949-1968 period. The 1949 production labour share of 45.1 percent was more than one-fifth higher than the 38.6 percent in all manufacturing and only three of the industries studied had higher values. The total labour share in the same year was 56.2 percent, about one-sixth greater than the 48.6 percent in all manufacturing and exceeded in only four of the industries studied.

The 1961 production labour share was, at 45.5 percent, some 5.8 percent greater than the 1961-1968 average of 43.0 percent, but the 1961 total labour share, at 65.2 percent, was 11.6 percent above the average of 58.4 percent. While both 1961 figures are "out of line", the total labour share for 1961 must be regarded as sufficiently atypical that its use as a base weight in short-period computations is questionable. For this reason, an alternative computation of unit residual cost relative to total labour was made, using as the base weight the 1962 values. Using a smaller labour share for the base weight (and one that is more representative) reduced the values for unit residual cost and its growth from the base year (1961). This is seen from a comparison of the computations of annual trend rate of change in unit residual cost relative to total labour derived from the original and the alternative base weights:

Relative to:	Rate	S	R
Value added, mfg. - original	6.3%	10.7	.848
Value added, mfg. - alternative	5.8	9.1	.863
Value added, total - original	6.9	14.4	.809
Value added, total - alternative	6.2	11.4	.832

The unusually high base weights in the original computations would make for a marked difference between base-weighted and current-weighted computations not only of unit residual cost but also of change in the residual share of value added. A comparison of these computations may be obtained on request from the Canada Department of Labour, Economics and Research Branch.

While information has been presented on computed trend rates over the full period, there is sufficient reason to doubt their accuracy that the composition of implicit (value-added) price change for motor vehicle parts and accessories is presented only for the recent period, and because of the doubts also associated with the 1961 base weight for total labour, alternate equations are added below, incorporating a rate for unit residual cost computed by use of the alternative base labour weight introduced just above:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1961-68^{x}	(2.4	x	.455)	+	(4.8	x	.505)	=	3.5	3.8
Tot. lab., 1961-68^{x}	(2.2	x	.652)	+	(6.3	x	.348)	=	3.6	3.8
Tot. lab., 1961-68^{x}Alt.	(2.2	x	.599)	+	(5.8	x	.401)	=	3.6	3.8
Tot. lab., 1961-68^{y}	(2.2	x	.731)	+	(6.9	x	.269)	=	3.5	3.7
Tot. lab., 1961-68^{y}Alt.	(2.2	x	.671)	+	(6.2	x	.329)	=	3.5	3.7

x – related to value added manufacturing
y – related to value added total activity
A – as calculated from this equation
B – as calculated by computer (see Table 16)

The use of the alternative base weights makes no difference in the trend rate of change for implicit price.

Only the first of the above equations covers production labour only; it indicates that unit labour cost was about one-third of the implicit price change $\left(\frac{2.4 \times .455}{3.5} = .31\right)$.
In the following four equations unit labour cost constituted 39.9, 36.6, 46.0 and 42.2 percent respectively. The proportions were somewhat less, based on the alternative, that is, the third and fifth equations.

The unit residual cost was, of course, greatest, at more than two-thirds, with respect to production labour, in the first equation. Related to total labour and value added, manufacturing, the proportion was a little more than 60 percent, and related to total labour, value added, total activity, it was about 55 percent. Even in the last two equations where the residual weights were between one-half and two-thirds less than the labour weights, the much greater rate of increase in unit residual than in unit labour cost more than offset the smaller weight. The fact that unit residual cost increased more, relative to total than to production labour, indicates that the nonproduction labour portion of unit residual cost (of which it is part when unit residual cost is related to production labour) held down the rate of increase. It follows that nonlabour residual cost was increasing more rapidly than labour cost.

Smelting and refining

Exports have traditionally been of great importance to this industry in which nickel, copper and other nonferrous metals are processed. In 1965, according to statistics especially prepared for this study, 56.0 percent of the value of the industry's production was exported (see Table 1). At the same time imports accounted for 14.3 percent of total domestic sales for the output of this industry. It is almost entirely a supplier of raw materials or (to put it more correctly) goods in process to other industries that turn out many products, mostly of the durable goods variety, that are used by consumers, service industries and others.

Smelting and refining (Standard Industrial Classification code 295) consists of establishments primarily engaged in smelting ores bearing nonferrous metals or the refining of such metals. Such operations, when conducted at the mine site, are intended to be reported on separately from the mining operations. The industry is similar, under the revised S.I.C., introduced in 1960, to what was called, under the old classification, "non-ferrous metal smelting and refining". While introduction of the new establishment concept and the transfer of certain byproducts to other industries produced changes for which adjustment factors could be devised (see Appendix A), many other revisions were made to the data, especially on value added, for which it was not found possible to devise adjustment factors. This produced such serious discontinuities in the data on value added that analysis of full-period trends in implicit (value-added) price and unit residual cost (which, it will be recalled, is derived from a formula including value-added price) would have no meaning.

Because it is of some interest in itself, some attention is given to trends over the full period (1949 to 1968) in production, employment, compensation per worker, output per worker and unit labour cost. But most of the attention is on the recent (1961-1968) period when unit residual cost and implicit (value-added) price can be included.

Production increased less than average over both the full and short periods. Between 1949 and 1968 the increase was 146.2 percent, 14 percent less than the increase of 170.6 percent in all manufacturing, and between 1961 and 1968 the increase of 44.8 percent was 27 percent less than the 61.1 percent for all manufacturing (see Table 2). Because of breaks in the continuity of value added data, mentioned above (see also page 36), figures for the years 1949 to 1968 inclusive cannot be analyzed. Between 1961 and 1968 value added by manufacturing activity increased 59.7 percent, one-sixth less than the 71.0 percent increase for all manufacturing, and value added by total activity increased 61.7 percent, one-fifth less than the average of 78.1 percent. However, there were smaller increases in both kinds of value added in nine of the industries studied.

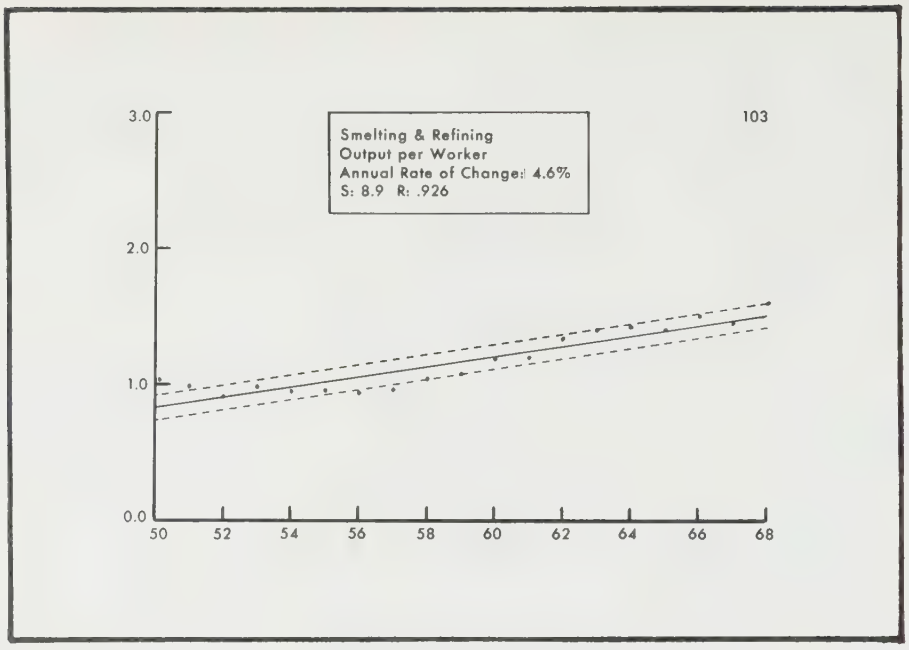
Employment increases in the industry were substantially above average over the full period for both categories of employment and almost as much below average over the short period. Production worker employment in 1968 was 53.8 percent greater than in 1949, almost twice the difference of 27.2 percent for all manufacturing, exceeded by only two of the industries studied (see Table 3). The increase between 1961 and 1968 was only 8.8 percent, less than half the average rise of 19.7 percent, but eight of the other industries either had smaller increases or experienced decreases in employment. The employment of total labour went up 74.7 percent over the full period, 2 1/4 times the 32.8 percent average rise, with only three of the industries studied showing larger increases, while over the short period the rise was 16.0 percent, slightly more than half the average of 29.8 percent, but 13 of the industries either experienced smaller increases or actual decreases.

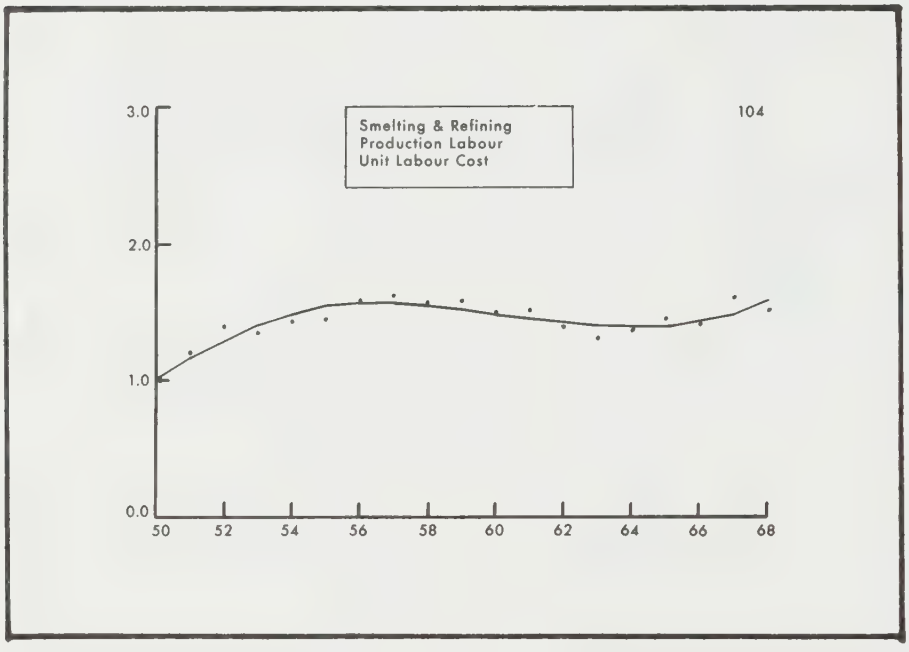
SMELTING AND REFINING

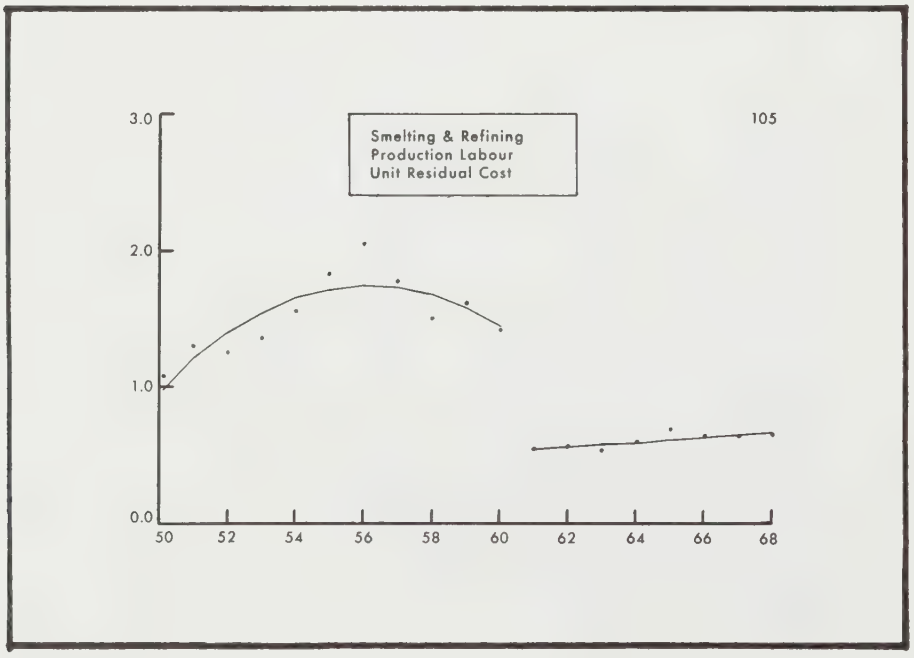
Summary Table – Principal Statistics

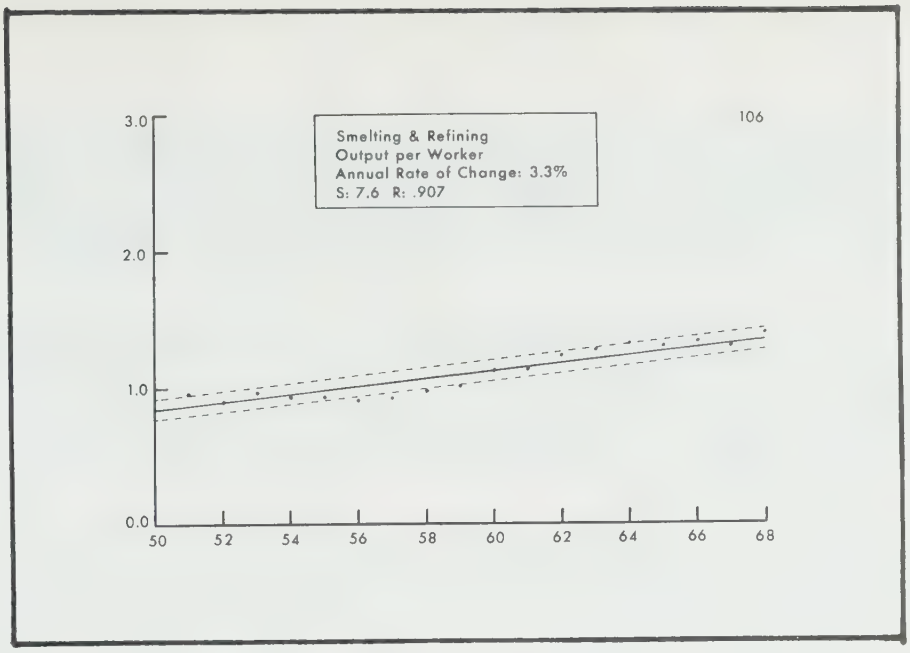
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			246.2			144.8			
Index of value added (1949 or 1961 = 100)			214.2			159.7		161.7	
Index of employment (1949 or 1961 = 100)	153.8	174.7		108.8	116.0				
Index of compensation per worker (1949 or 1961 = 100)	243.5	251.4		133.6	135.5				
Annual trend rate, compensation per worker	+6.4%	+6.9%		+5.7%	+5.8%				
Implicit, value-added price – index, 1949 or 1961 = 100						110.3		111.6	
– Annual trend rate of change						+3.0%		+3.1%	
– R value						.833		.813	
Output per worker – index, 1949 or 1961 = 100	160.0	141.0		133.1	124.9				
– Annual trend rate of change	+4.6%	+3.3%		+2.6%	+1.8%				
– R value	.926	.907		.894	.878				
Unit labour cost – index, 1949 or 1961 = 100	152.2	178.3		100.4	108.5				
– Annual trend rate of change	+1.0%	+2.0%		+2.5%	+3.4%				
– R value	.461	.741		.793	.926				
Unit residual cost – index, 1949 or 1961 = 100				113.5	111.0		114.9		
– Annual trend rate of change				+3.1%	+2.8%		+2.7%		
– R value				.799	.721		.543		
Payroll as a proportion of value added 1949									
1961				47.8%	63.1%		50.5%		
1968	43.5%	62.1%					49.1%		
Trend rate of change in labour share				−0.4%	+ 0.3%		+ 0.2%		
– R value				.234	.152		.113		
Trend rate of change in residual share				+0.1%	−0.1%		−0.2%		

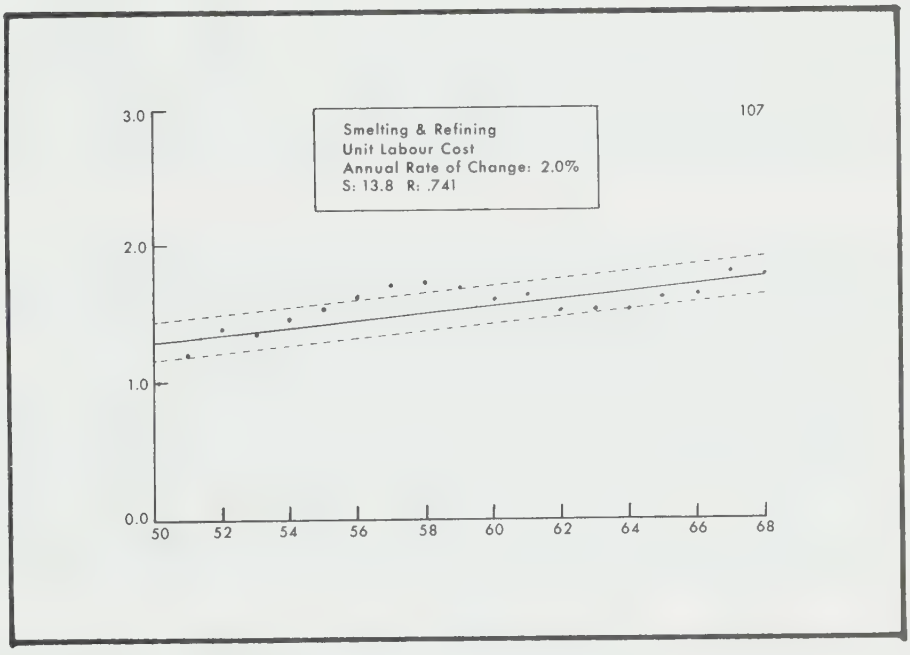
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

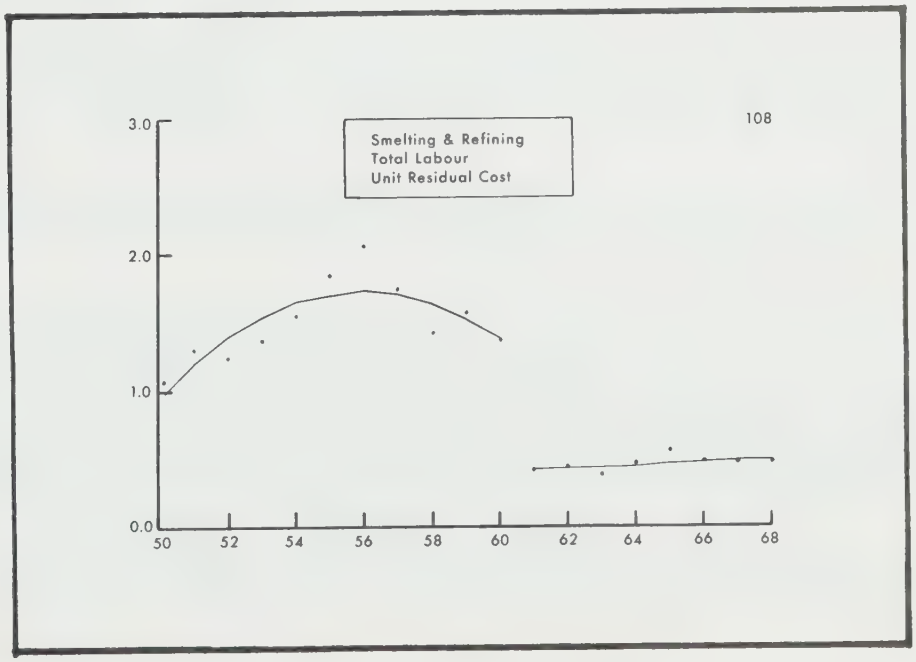

103
Smelting & Refining
Output per Worker
Annual Rate of Change: 4.6%
S: 8.9 R: .926
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


104
Smelting & Refining
Production Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


105
Smelting & Refining
Production Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


106
Smelting & Refining
Output per Worker
Annual Rate of Change: 3.3%
S: 7.6 R: .907
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


107
Smelting & Refining
Unit Labour Cost
Annual Rate of Change: 2.0%
S: 13.8 R: .741
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


108
Smelting & Refining
Total Labour
Unit Residual Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

There was a substantial shift between 1949 and 1968 in the proportions of production and nonproduction workers. In 1949 the production worker proportion was 85.5 percent which dropped one-eighth to 75.3 percent in 1968, following a statistically strong trend rate of decrease of -0.6 percent per annum (see Table 5). The production worker proportion moved from being slightly above average in 1949 (85.5 percent, compared with 81.1 percent) to slightly below in 1968 (75.3 percent, compared with 77.7 percent).

Compensation (annual wages, annual wages and salaries) per worker did not increase quite as much as the average for both labour categories over both periods. For production labour the increase from 1949 to 1968 was 143.5 percent, 11 percent less than the increase of 161.5 percent in all manufacturing, and the annual trend rate of increase of 6.4 percent was also 11 percent below the average which was 7.2 percent; only three of the industries studied showed smaller rates (see Table 11). From 1961 to 1968 the increase was 33.6 percent, about one-quarter less than the average rise of 43.9 percent, while the annual trend rate of increase of 5.7 percent was almost ten percent less than the average of 6.3 percent; eight of the industries experienced lower rates of increase.

Between 1949 and 1961 annual wages per production worker, average hourly earnings and occupational wage rates increased to about the same extent in this industry 82.2, 89.7 and 87.0 percent respectivley (see Table 9A). Wage rate data are not available for the industry after 1964; between 1961 and 1964 the three increases were 7.6, 8.4, and 7.1 percent. Hourly earnings continued to increase somewhat more than annual earnings through to 1968, the 1961-1968 increases being 33.6 and 36.0 percent. Possible reasons for such differences are set forth in the section on wages in Chapter Six.

Implicit (value-added) price increased more than average between 1961 and 1968,[30] by 10.3 percent, compared with 6.2 percent in all manufacturing (see Table 12); the annual trend rate of increase of 3.0 percent was more than three times the rate of 0.9 percent for all manufacturing but it was exceeded in eight other industries (see Table 16). Related to value added by total activity, the increase was 11.6 percent between 1961 and 1968, only slightly more than the 10.5 percent for all manufacturing, but the difference was greater in the annual trend rate, but not as much as with respect to value added by manufacturing, namely, 3.1 percent, or not quite twice the average rate of 1.7 percent; eight of the industries had higher rates.

The industry selling price index rose much more over this period than value-added price. Between 1961 and 1968 it moved up 33.6 percent, compared with implicit price increases of 10.3 percent (value added, manufacturing) and 11.6 percent (value added, total activity). This suggests a rather substantial increase in the cost of raw material or fuel and energy inputs which are components of the wholesale-type industry selling price but not of value-added price.

Labour productivity increases in this industry were less than average over both the full and short periods. The increase between 1949 and 1968 in output per production worker of 60.0 percent was little better than half of the average increase of 112.7 percent (see Table 17); the annual trend rate of increase of 4.6 percent was almost one-quarter less than the rate of 5.9 percent for all manufacturing, but four of the industries studied had lower rates (see Table 19). Between 1961 and 1968 the increase with respect to production labour was 33.1 percent, almost the same as the 34.6 percent for all manufacturing, but the annual trend rate of increase of 2.6 percent was almost one-third less than the average rate of 3.7 percent, but nine industries showed lower rates, compared with four industries over the full period.

The increases for total labour were less than for production labour only and even more below average. Output per worker rose 41.0 percent over the full period, 60 percent less than the average increase of 103.7 percent; the trend rate of 3.3 percent was almost 40 percent less than the average of 5.8 percent (compared with a 25 percent difference for production labour only); three of the industries had lower rates and two had rates almost the same. Between 1961 and 1968 the increase was 24.9 percent, fractionally more than the 24.1 percent for all manufacturing, but two year-over-year decreases and one quite small increase between two other years (see Table 17) contributed to a trend rate of 1.8 percent that was not only 30 percent less than that for production labour only but less than half the 3.9 percent for all manufacturing. Nevertheless, four of the other industries had lower rates of increase.

While compensation per worker increased rather less than average in smelting and refining, increases in output per worker were even more below average, with the expected result that unit labour cost increased more than average. This was so for both categories of labour and over both time periods.

Between 1949 and 1968 the increase with respect to production labour was 52.2 percent, 2 1/4 times the increase in all manufacturing (see Table 24), while the annual trend rate of change of 1.0 percent was twice the average rate of 0.5 percent, with, however, four other industries having higher rates (see Table 26)[31]. Over the short period there was a trend rate of increase in unit labour cost for production labour of 2.5 percent per annum, one-quarter greater than the rate for all manufacturing, but less than in seven other industries. There was a fall of eight percent between 1961 and 1962, a further but smaller reduction by 1963, a rise of more than 20 percent by 1967, and then a drop of almost seven percent in 1968; all of which explains why there was an uptrend even though the 1968 index was almost identical with that for 1961.

With respect to total labour, there was an increase between 1949 and 1968 of 78.3 percent, 2 1/2 times the average increase of 30.8 percent, and the trend rate was 2.0 percent, twice the rate for production labour only, and almost three times

the rate of 0.7 percent for all manufacturing, but less than the rates for four of the other industries studied. Between 1961 and 1968 the increase was 8.5 percent, less than half of the 17.6 percent for all manufacturing, but that is because of a relatively high index in this industry for 1961 (over 1949); because of a sharp drop between 1961 and 1962, followed by a steady rise thereafter (see Table 24), the annual trend rate of increase was 3.4 percent, more than 75 percent above average, although it was exceeded in five other industries.

It will be observed that unit labour cost increased at a much faster rate in the short than in the full period and much more for total labour than for production labour in both time periods.

It has already been explained that a break in the continuity of value-added data renders of no meaning any computation of change in unit residual cost over the full period. However, the charts contain the values for all the years and a nonlinear curve has been fitted for the 1949-1960 period. The trend for 1961-1968 can be clearly seen from the charts to be linear.

Unit residual cost increased over the short period somewhat more than unit labour cost when both are related to production labour only and somewhat less when related to total labour. It follows that unit nonproduction labour cost increased not only more than unit production labour cost, which has already been observed, but also more than unit nonlabour residual cost. This is because unit residual cost relative to production labour has a nonproduction labour as well as nonlabour component while it contains exclusively nonlabour cost only when related to total labour.

Between 1961 and 1968 unit residual cost with respect to production labour increased 13.5 percent, compared with 5.8 percent in all manufacturing (see Table 28); the annual trend rate of increase of 3.1 percent was exceeded by the rates in six other industries (see Table 31).[32] Over the same period the increase in the measure related to total labour was 11.0 percent, while there was a small 1.2 percent decline in all manufacturing; the annual trend rate of increase of 2.8 percent was exceeded in nine industries. Related to total labour and value added, total activity, the short-period increase was 14.9 percent, compared with 5.0 percent for all manufacturing, and the trend rate, at 2.7 percent, was two-thirds higher than the average rate of 1.6 percent but nine industries had higher rates of increase.

A glance at the data on labour share of value added (see Table 34) shows why it showed no trend over the short period to increase or decrease. While the production labour share for 1968 was nine percent less than in 1961, the latter figure was unusually high. Over 1961-1968 the labour shares averaged 44.3 percent for production labour and 60.6 percent for total labour, both relative to value added, manufacturing, and 47.8 percent for total labour relative to value added by total activity. These were all higher than comparable figures for all manufacturing, the first two being notably higher. Smelting and refining must be considered labour intensive, relative to the average for all manufacturing, and a comparison of the 1961 labour weights used in the implicit (value-added) price equations shows only two of the industries studied with higher values for production labour relative to value added, manufacturing, the same number for total labour relative to value added, manufacturing but nine such industries in the case of total labour relative to value added, total activity.

Because the 1961 labour shares in each case were higher than for any of the subsequent years, current-weighted computations of change in the residual share were rather different from base-weighted computations. Comparative data may be obtained on request from the Canada Department of Labour, Economics and Research Branch.

Excluding the full period, the composition of implicit (value-added) price change for smelting and refining for the period 1961 to 1968 is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1961-68[x]	(2.5	x	.478)	+	(3.1	x	.522)	=	2.8	3.0
Tot. lab., 1961-68[x]	(3.4	x	.631)	+	(2.8	x	.369)	=	3.2	3.0
Tot. lab., 1961-68[y]	(3.4	x	.505)	+	(2.7	x	.495)	=	3.1	3.1

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

In the first equation unit labour cost constitutes 42.7 percent of price change $\left(\frac{2.5 \times .478}{2.8} = .427\right)$ in the second equation it is 67.0 percent and in the third, 55.4 percent.

Electrical products

Import competition appears to be more important to this industry than export trade, at least on the basis of 1965 statistics compiled for this study on an industry basis from commodity data (see Table 1). In that year exports constituted 6.6 percent of the value of production and imports accounted for 18.3 percent of the value of total market sales of products of the industry. This may have changed in more recent years with the apparent increase in the sales of Japanese-made television, radio and other electronic items; but data have not been compiled on this. This industry produces many articles for direct use by the consumer as well as others for use by other industries. Electrical appliances account for 2.0 percent of the consumer price index, light bulbs and automobile batteries another 0.1 percent each.

The electrical products industries (called an industry in this section for the sake of simplicity) comprise the following, under the unrevised 1960 Standard Industrial Classification:[33] small electrical appliances (S.I.C. code 331) including the manufacture of vacuum cleaners, fans, irons and water heaters and toasters; major appliances, electric and nonelectric (S.I.C. code 332) including household-type appliances and machines such as stoves, refrigerators, home and farm freezers, windowtype air conditioning units, laundry equipment and sewing machines; household radio and television receivers (S.I.C. code 334), plus the manufacturing of record playing, tape playing and recording equipment and parts; communications equipment (S.I.C. code 335) including radio and television transmitters, radar equipment, closed circuit television equipment, electronic navigational aids, public address apparatus, and related parts and equipment, as well as establishments primarily engaged in manufacturing telephone and telegraph equipment and parts, electronic control panels, etc.; electrical industrial equipment (S.I.C. code 336) such as electric motors, generators and other electric power equipment used in the generation, transmission and utilization of electric energy; batteries (S.I.C. code 337) including wet and dry batteries; electric wire and cable (S.I.C. code 338); and miscellaneous electrical products not elsewhere classified (S.I.C. code 339) such as lighting fixtures, light bulbs and tubes, other kinds of electric lamps, panelboards, low voltage switchboards, etc. as well as establishments primarily engaged in manufacturing electronic computers and data processors.

No serious changes accompanying the introduction of the new S.I.C. affected continuity of data based on the old and new classifications. Adjustment factors to allow for continuity are described and set out in Appendix A. It would undoubtedly have been better to have restricted our analysis to one or two of the industries comprising this group but this was not feasible partly because of problems of data continuity if only a certain industry or certain industries were singled out. If this study is followed by further research, it is hoped that more disaggregative analysis will be possible for industries like this.

Production increased much more than average in this industry over both the full and short periods. Because of declining implicit (value-added) price, value added, while increasing more than average, did so by a smaller margin than production.

The increase in production between 1949 and 1968 was 309.6 percent, more than 80 percent above the increase of 170.6 percent for all manufacturing, and exceeded by only two of the industries studied (see Table 2). Between 1961 and 1968 there was a rise of 94.6 percent, more than 50 percent above the average, which was 61.1 percent, and again exceeded by only two industries. Over the full period value added rose by 311.3 percent which just about matched the rise in real output. This was some 20 percent greater than the rise of 259.9 percent for all manufacturing, but seven industries showed greater increases. Between 1961 and 1968 the rise was 89.2 percent, again very close to the rise in real output, some 25 percent greater than the average increase, but exceeded in five industries. Over the short period, value added by total activity behaved in almost an identical fashion; the increase was 90.9 percent which exceeded the average by a slightly smaller margin, 16 percent, and, as with value added, manufacturing, was exceeded by higher increases in five other industries.[34]

Employment of both production workers and total labour increased much more than average over both the full and short periods. Between 1949 and 1968 the rise of 62.4 percent for production labour was more than 2 1/4 times greater than the rise of 27.2 percent for all manufacturing; indeed, only one of the industries studied experienced a greater increase (see Table 3). Between 1961 and 1968 the rise of 47.2 percent for production labour was 2.4 times the 19.7 percent for all manufacturing and was exceeded in only two industries among those studied. Total labour employment went up 79.4 percent over the full period, almost 2 1/2 times the increase of 32.8 percent for all manufacturing, and over the short period the increase of 39.1 percent was about one-third greater than the average rise of 29.8 percent; over both periods only two industries showed greater increases.

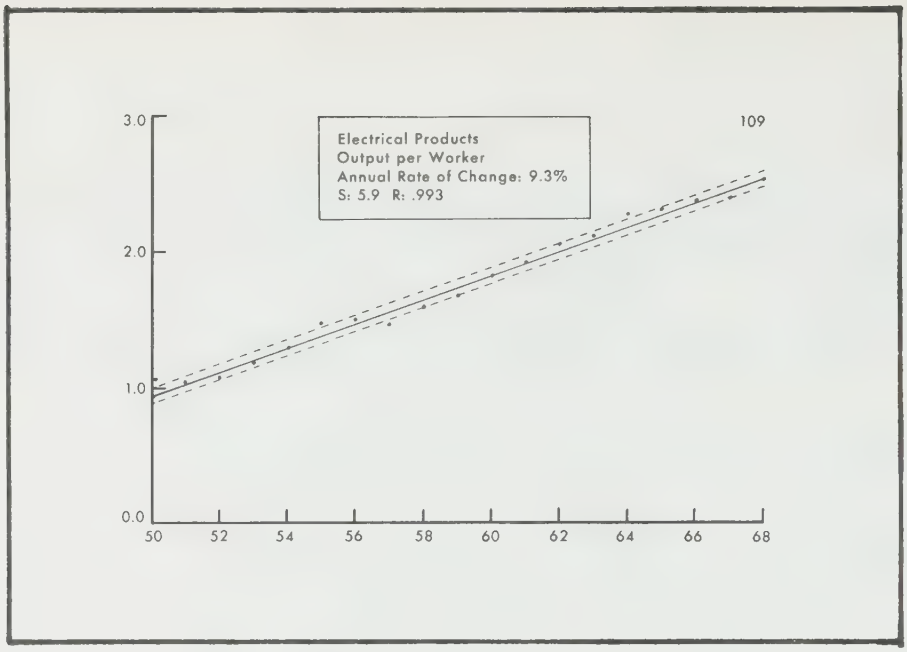
Over the full period total employment increased more than that of production labour but over the more recent, short period production labour registered the greater increase. There was a reduction in the proportion of production workers to total employment from 76.3 percent in 1949 to 70.8 percent in 1967 (a 1968 figure was not available when the data were prepared). However, the trend towards a reduced production worker proportion, if it is a trend, was not very strong (see Table 5). The proportion was less than that for all manufacturing in 1949 and 1967.

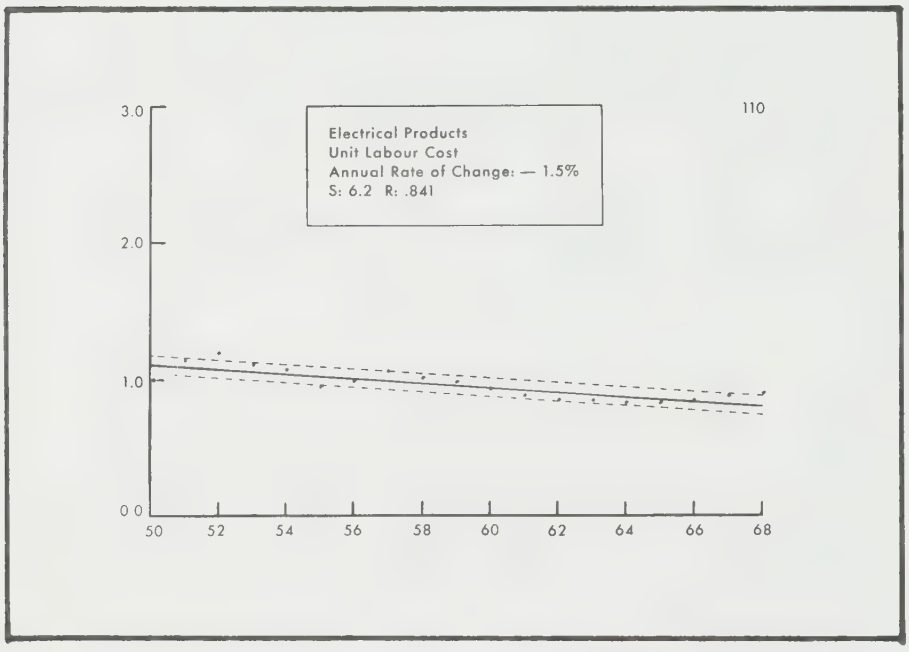
ELECTRICAL PRODUCTS

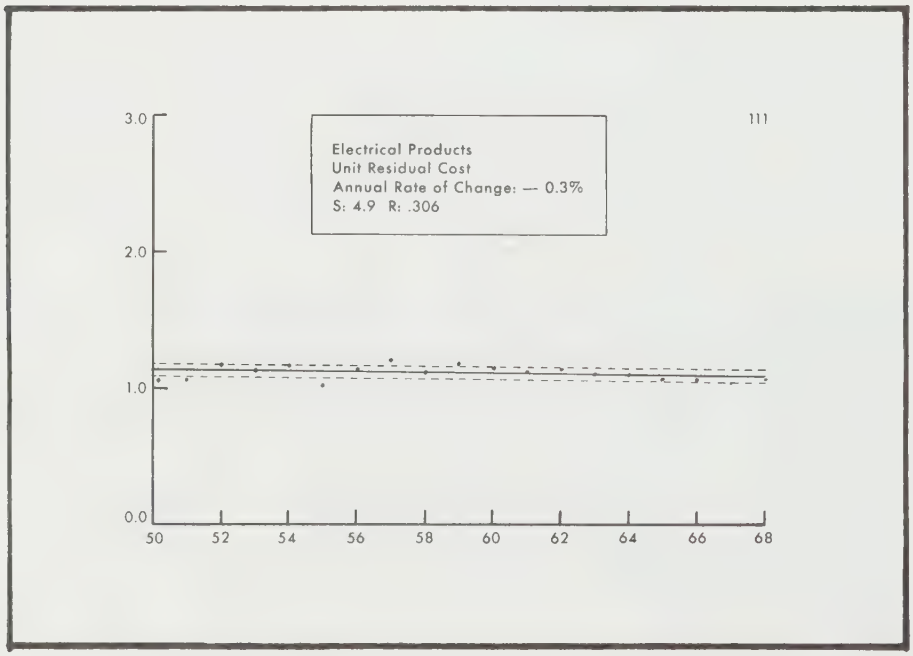
Summary Table — Principal Statistics

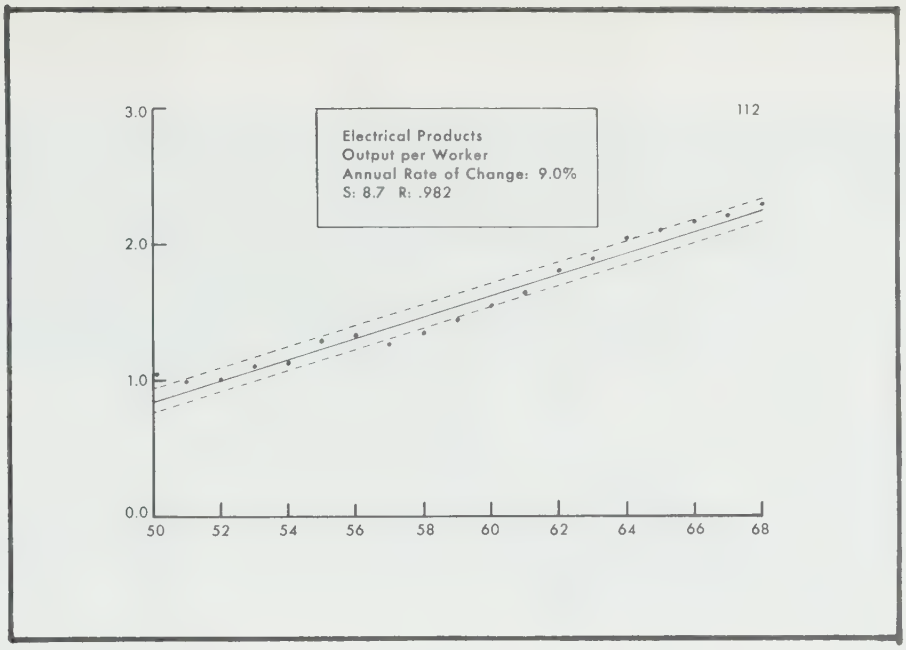
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			409.6			194.6			
Index of value added (1949 or 1961 = 100)			411.3			189.2		190.9	
Index of employment (1949 or 1961 = 100)	162.4	179.4		147.2	139.1				
Index of compensation per worker (1949 or 1961 = 100)	227.8	222.5		134.3	121.7				
Annual trend rate, compensation per worker	+5.1%	+5.6%		+4.9%	+3.5%				
Implicit, value-added price — index, 1949 or 1961 = 100			100.4			97.3		98.0	
— Annual trend rate of change			−0.7%			−0.4%		−0.3%	
— R value			.704			.602		.429	
Output per worker — index, 1949 or 1961 = 100	252.3	228.4		132.2	139.9				
— Annual trend rate of change	+9.3%	+9.0%		+3.5%	+4.4%				
— R value	.993	.982		.975	.984				
Unit labour cost — index, 1949 or 1961 = 100	90.3	97.4		101.6	87.0				
— Annual trend rate of change	−1.5%	−1.1%		+1.0%	−0.7%				
— R value	.841	.638		.706	.642				
Unit residual cost — index, 1949 or 1961 = 100	106.2	103.5		95.3	109.8		109.1		
— Annual trend rate of change	−0.3%	+0.2%		−1.1%	−0.1%		+0.1%		
— R value	.306	.247		.906	.152		.047		
Payroll as a proportion of value added 1949	36.3%	51.0%							
1961				31.2%	55.3%		49.8%		
1968	32.6%	49.5%					44.2%		
Trend rate of change in labour share	−0.9%	−0.5%		+1.4%	−0.3%		−0.4%		
— R value	.819	.440		.914	.291		.438		
Trend rate of change in residual share	+0.5%	+0.6%		−0.8%	+0.2%		+0.3%		

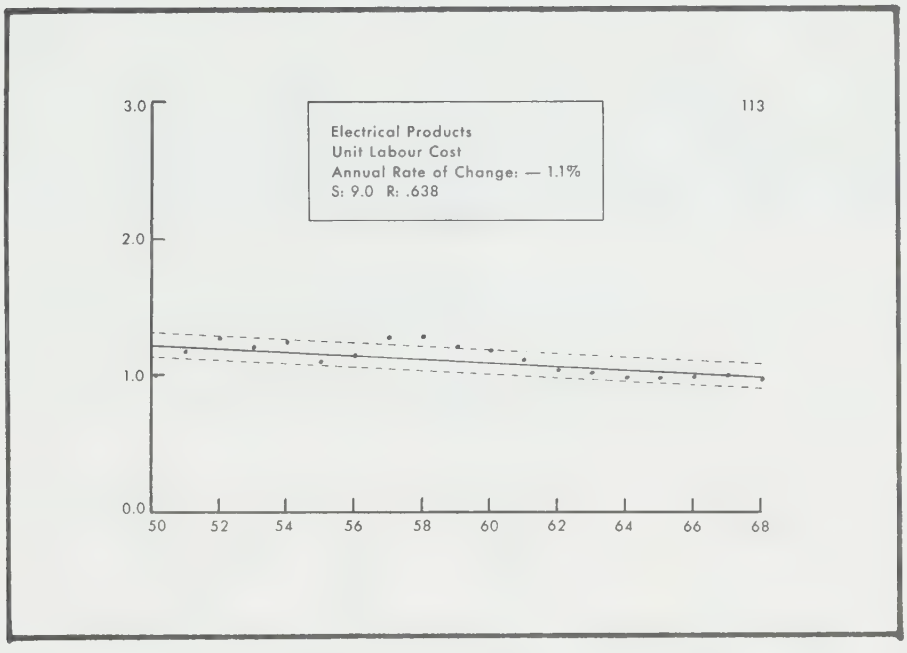
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

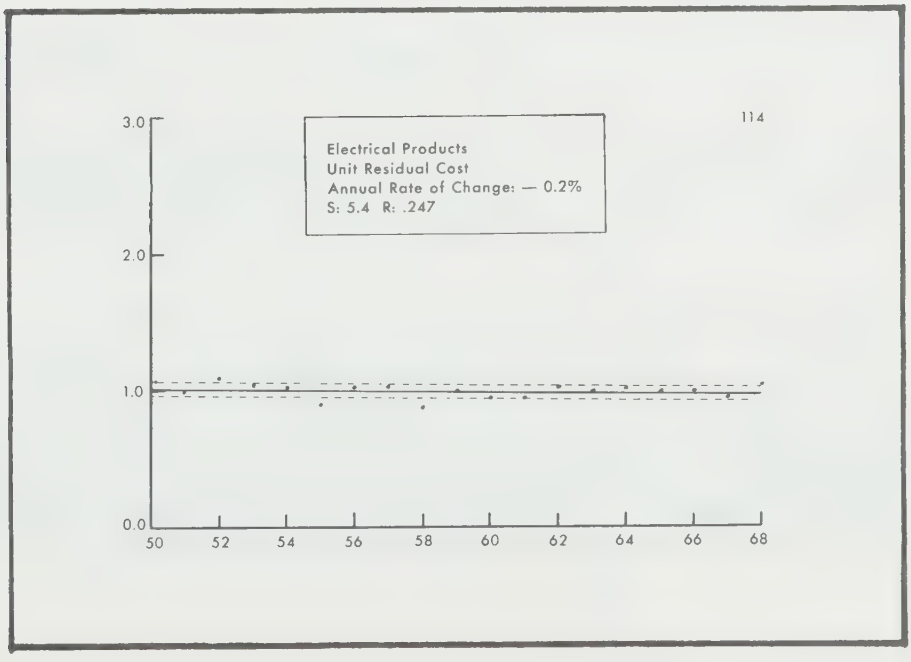

109
Electrical Products
Output per Worker
Annual Rate of Change: 9.3%
S: 5.9 R: .993
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


110
Electrical Products
Unit Labour Cost
Annual Rate of Change: — 1.5%
S: 6.2 R: .841
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


111
Electrical Products
Unit Residual Cost
Annual Rate of Change: — 0.3%
S: 4.9 R: .306
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


112
Electrical Products
Output per Worker
Annual Rate of Change: 9.0%
S: 8.7 R: .982
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


113
Electrical Products
Unit Labour Cost
Annual Rate of Change: — 1.1%
S: 9.0 R: .638
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


114
Electrical Products
Unit Residual Cost
Annual Rate of Change: — 0.2%
S: 5.4 R: .247
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Compensation (annual wages, annual wages and salaries) per worker increased significantly less than average for both categories of labour over both time periods. For production labour compensation per worker was 127.8 percent greater in 1968 than in 1949, one-fifth less than the 161.5 percent in all manuafacturing; the annual trend rate of increase of 5.1 percent was about one-third less than the rate of 7.2 percent for all manufacturing; only one industry, among those studied, had a lower rate, and it was 5.0 percent (see Table 11). Between 1961 and 1968 the increase for production labour was 34.3 percent, one-fifth less than the average increase of 43.9 percent; the trend rate was 4.9 percent per annum, more than one-fifth less than the rate of 6.3 percent in all manufacturing. Over both the full and short periods the increases in annual wages per worker, average hourly earnings, and occupational wage rates were very similar; for 1949 to 1968 they were 127.8, 130.1, and 135.7 percent, and for 1961 to 1968 they were 34.3, 32.8, and 33.8 percent (see Table 9A).

For total labour, compensation (in this case, annual wages and salaries) per worker increased 122.5 percent between 1949 and 1968, more than 25 percent less than the average rise of 166.5 percent. The annual trend rate of increase of 5.6 percent was somewhat higher than the 5.1 percent for production labour but 25 percent below the rate of 7.5 percent for all manufacturing; only one industry had a lower rate and one had the same rate (see Table 11). Between 1961 and 1968 the increase of 21.7 percent was less than half the average increase of 45.9 percent; the trend rate of 3.5 percent was significantly less than the 4.9 percent for production labour and little more than half of the 6.3 percent for all manufacturing. It was the lowest rate of increase for any of the industries studied.

Implicit (value-added) price followed a slight downward movement over both the full and short periods. However, as will be observed from Table 12, it was subject to many fluctuations. The index for 1968, at 100.4 was virtually the same as for 1949, but it was as high as 117.9 in 1952 and as low as 98.2 in 1967. Over the full period the annual trend rate of decrease was -0.7 percent; four other industries among those studied showed a downtrend and for two of them the rate was greater (see Table 16). Over the same period there was an annual trend rate of increase of 1.0 percent for all manufacturing. Between 1961 and 1968 the trend rate of decrease was -0.4 percent, while for all manufacturing there was a rate of increase of 0.9 percent. For this period also, four industries showed a downtrend in implicit price, but they were not all the same industries, and each exhibited a stronger downtrend than this industry. A similar comparison applies to short-period trend in implicit price relative to value added by total activity (the other data all being related to value added, manufacturing). This is one of the few industries to show decreasing implicit price over the time period under review.

There is no industry selling price index for the electrical products industries as such but indexes are available for each of the component industries except communications equipment. The changes in these indexes between 1961 and 1968 were as follows:

Small electrical appliances	- 3.8%
Major appliances	- 1.2
Household radio and television receivers	- 1.0
Electrical industrial equipment	+ 0.6
Batteries	+14.3
Electric wire and cables	+29.5
Miscellaneous electrical products	+ 4.7

The consumer (retail) price indexes, over the same period declined 3.6 percent for radios, 7.9 percent for a console television receiver, while an index covering all durable household appliances, most of which are electrical, moved down 4.2 percent; at the same time the index for automobile batteries moved up 14.0 percent.

Labour productivity increased considerably more than average over the full period for both categories of labour; over the short period it was slightly less than average for production labour and slightly more than average for total labour.

Between 1949 and 1968 output per worker for production labour rose 152.3 percent, more than one-third higher than the increase of 112.7 percent for all manufacturing (see Table 17). The annual trend rate of increase was 9.3 percent, close to 60 percent more than the 5.9 percent for all manufacturing, but there were seven other industries with higher rates (see Table 19). Between 1961 and 1968 the increase was 32.2 percent, slightly less than the 34.6 percent for all manufacturing, and, similarly, the annual trend rate of increase, at 3.5 percent, was just slightly below the 3.7 percent for all manufacturing.

For total labour, as with production labour, the increases were much smaller over the short period than over the full period, meaning that output per worker increased more in the 1950's than in the 1960's. For total labour the increase between 1949 and 1968 was 128.4 percent, almost one-quarter greater than the 103.7 percent in all manufacturing; the annual trend rate of increase was 9.0 percent, a little less than the 9.3 percent for production labour, and more than one-half greater than the rate of 5.8 percent in all manufacturing; seven industries showed larger rates (see Table 19). Between 1961 and 1968 there was a rise of 39.9 percent, about two-thirds greater than the 24.1 percent for all manufacturing. The trend rate of increase of 4.4 percent per annum was not only one-quarter greater than the 3.5 percent for production labour, but one-eighth greater than the 3.9 percent for all manufacturing; however, seven other industries had higher rates and one had the same rate.

Unit labour cost with respect to production labour was 9.7 percent less in 1968 than in 1949, compared with an average increase of 23.0 percent (see Table 24). There was an annual trend rate of decrease of -1.5 percent while there was a rate of increase of 0.5 percent for all manufacturing; ten other industries experienced rates of decrease, three of which were greater than in electrical products (see Table 26). Between 1961 and 1968 there was a small increase of 1.6 percent while in all manufacturing the rise was 6.9 percent; however, the annual trend rate of increase was 1.0 percent, resulting from the fact that while the index for 1961 was close to that for 1968, unit labour cost fell for the next three years and then moved back up to a level by 1968 slightly in excess of that for 1961. However, the rate of increase of 1.0 percent, while a reversal from the rate of decrease of -1.5 percent for the full period, was only half the 2.0 percent for all manufacturing; indeed, 14 of the industries had a higher rate and one had the same rate (see Table 26).

Unit residual cost showed little indication of a trend upward or downward over the full period relative to both categories of labour and with respect to total labour over the short period. With the exception of production labour over the short period, it can be seen from the summary table of statistics that none of the R values (measuring goodness of fit) were statistically significant. Attempts to fit the data over the full period to a nonlinear function improved the fit somewhat, but even then the trend was not strong (see Appendix C). This can be discerned from an inspection of the charts and the data in Table 28. Relative to production labour, unit residual cost increased 17.0 percent from 1949 to 1952, fell 3.2 percent the next year, increased 2.9 percent the year after that, dropped again, this time by 12.2 percent, increased the next two years by 17.6 percent, then dropped 6.9 percent, followed by a 4.6 percent rise and a drop the next two years of 4.7 percent, bringing us to 1961. From then until 1968 the pattern was of a rather steady decline, indicated by the high R value (.906) for this period only. However, erratic behaviour, such as that described for the 1950's indicates no trend, which was also the case for total labour over the whole period and over the short period with respect to value added, total activity, as well as value added, manufacturing.

The lack of any significant trend in unit residual cost with respect to total labour is reflected in a similar lack of trend in the total labour share. On the other hand, probably as a result chiefly of the strong short-period trend in unit residual cost relative to production labour, a significant trend in the production labour share is discernible over both the full and the short periods, except that it is an upward trend over the short period and a downward trend over the full period. However, the production labour share was so small in this industry that the trend rates of change, being rather small anyway, do not indicate any great shift in the labour share.

The production labour share in 1949 was 36.3 percent, 31.2 percent in 1961, and 32.6 percent in 1968. The annual trend rate of decrease over the full period was -0.9 percent and considering that one percent of 30 percent is only 0.3 percent, these rates do not indicate any basic change in factor shares. Over the full period the production labour share averaged around 33 percent and around 31 percent over the short period, while the total labour share averaged about 54 percent over the full period and also a little less, at about 52 percent, over the short period.

The composition of implicit (value-added) price for the electrical products industries is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-1.5	x	.363)	+	(-0.3	x	.637)	=	-0.7	-0.7
Tot. lab., 1949-68[x]	(-1.1	x	.510)	+	(-0.2	x	.490)	=	-0.7	-0.7
Prod. lab., 1961-68[x]	(1.0	x	.312)	+	(-1.1	x	.688)	=	-0.4	-0.4
Tot. lab., 1961-68[x]	(-0.7	x	.553)	+	(-0.1	x	.447)	=	-0.4	-0.4
Tot. lab., 1961-68[y]	(-0.7	x	.498)	+	(-0.1	x	.502)	=	-0.3	-0.3

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

An explanation of the value in columns A and B is set forth in the same part of the section of this chapter covering slaughtering and meat processors. In this industry there are no differences between the columns.

In the first two equations both unit cost trend rates are negative, but the unit labour cost trend constitutes 70 percent of the implicit price change. In the third equation, the residual weight is more than twice the labour weight and the trend rates of change, while of about the same magnitude, have opposite values, - labour positive, residual negative, - so it follows that the trend rate is negative. In the last two equations unit residual cost is barely a component at all, not only because of the very small trend rates but also because the rates are, in fact, without statistical significance. Indeed, only in the third equation, with respect to production labour over the short period, is unit residual cost a sizeable component.

The small changes in unit cost and the fact that they were mostly downward, are reflected in the modest downtrend in implicit (value-added) price in this industry.

Cement manufacturers

Foreign trade has been of negligible importance to this industry, either as an outlet for exports or as a source of import competition. On the basis of statistics compiled on an industry basis for this study from commodities data, exports constituted only 3.8 percent of the value of the industry's production in 1965 and 1.5 percent of the value of total market sales of the industry's product was made up of imports (see Table 1). The industry is of obvious importance to most branches of the construction industry including not only residential, commercial and industrial construction, but also highways, roads and bridges.

Cement manufacturers (Standard Industrial Classification code 341) comprise establishments primarily engaged in manufacturing hydraulic cement, including Portland, natural masonry and puzzolan cements. No significant changes in the components of the industry were introduced into the revised S.I.C. code put into effect in 1960 and whatever adjustments were necessary to the data to ensure continuity between the old and the new series are set forth in Appendix A.

Production in this industry increased less than average over the full period and much less over the short period. The increase between 1949 and 1968 of 149.7 percent was one-eighth less than the increase of 170.6 percent for all manufacturing, and the increase of 14.9 percent between 1961 and 1968 was only one-quarter of the average 61.1 percent rise. Indeed, of the industries studied, only one showed a smaller increase over the recent period. However, it must be pointed out that 1965 and 1966 were years of much higher output, 1966 reaching a peak of 190.7 percent over 1949, followed by a drop of almost 15 percent between 1966 and 1968 (see Table 2).

Notwithstanding the low increases in output, because of the much higher than average increase in implicit (value-added) price (to be discussed further on), value added increased considerably more than average over the full period. However, the small increase in real output was not sufficiently augmented by the relatively high implicit price increase over the short period, so that value added increased less than average.

Between 1949 and 1968 value added increased 408.5 percent, 57 percent more than the rise of 259.9 percent for all manufacturing, exceeded in only two of the industries studied and matched in another. In contrast, between 1961 and 1968 the increase in value added by manufacturing was 40.1 percent, little better than half the increase of 71.0 percent in all manufacturing; for value added by total activity the increase was 38.3 percent, just half of the 78.1 percent for all manufacturing. However, six industries had lower increase in value added by manufacturing over the short period.

Employment increases were greater than average over the full period and less than average over the short period; in fact, in the recent period production labour employment decreased slightly. Between 1949 and 1968 production worker employment increased 55.5 percent, more than twice the 27.2 percent for all manufacturing, and exceeded in only two of the industries studied (see Table 3). However, between 1961 and 1968 there was a decline of 2.1 percent; there had been a rise of 10 percent from 1961 to 1966, followed by a drop of 11 percent between 1966 and 1968. However, greater reductions in employment over the short period took place in four other industries.

The employment of total labour was 87.7 percent greater in 1968 than in 1949, an increase of 2 2/3 times the 32.8 percent for all manufacturing, an increase exceeded in only one of the industries studied. Between 1961 and 1968 the increase was only 4.4 percent, just about one-seventh the increase of 29.8 percent for all manufacturing. However, six other industries had either smaller increases or showed reductions in total employment over this period.

The proportion of production labour to total employment dropped remarkably between 1949 and 1968. In 1949, at 93.0 percent, it was higher than for any of the other industries covered by this study, to be compared with 81.1 percent for all manufacturing; by 1968 it was down to 77.0 percent, fractionally less than the 77.7 percent for all manufacturing. This was a reduction of 17.2 percent and constituted an annual trend rate of decrease of -1.0 percent (with high statistical significance; see Table 5).

Compensation (annual wages, annual wages and salaries) per worker increased about in line with the average for both production and total labour, a little more than average over the full period and a little less than average over the short period.

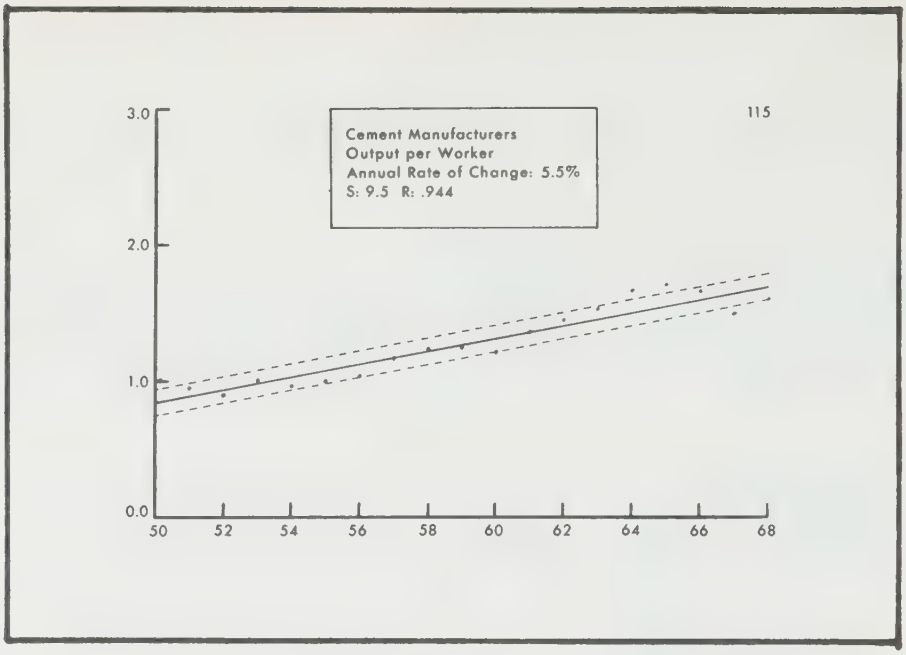
For production labour the increase between 1949 and 1968 of 159.0 percent was almost the same as the 161.5 percent for all manufacturing; similarly with the annual trend rate of increase of 7.4 percent compared with the average of 7.2 percent. The 1961-1968 increase of 40.1 percent was just a little less than the 43.9 percent for all manufacturing, while the trend rate of increase of 6.1 percent similarly fell slightly behind the 6.3 percent for all manufacturing.[35]

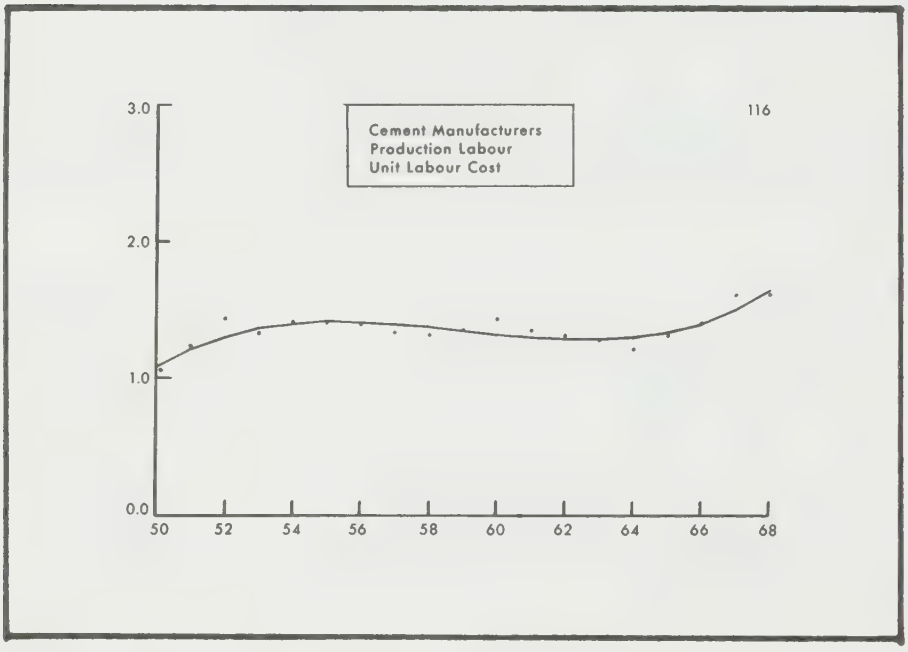
CEMENT MANUFACTURERS

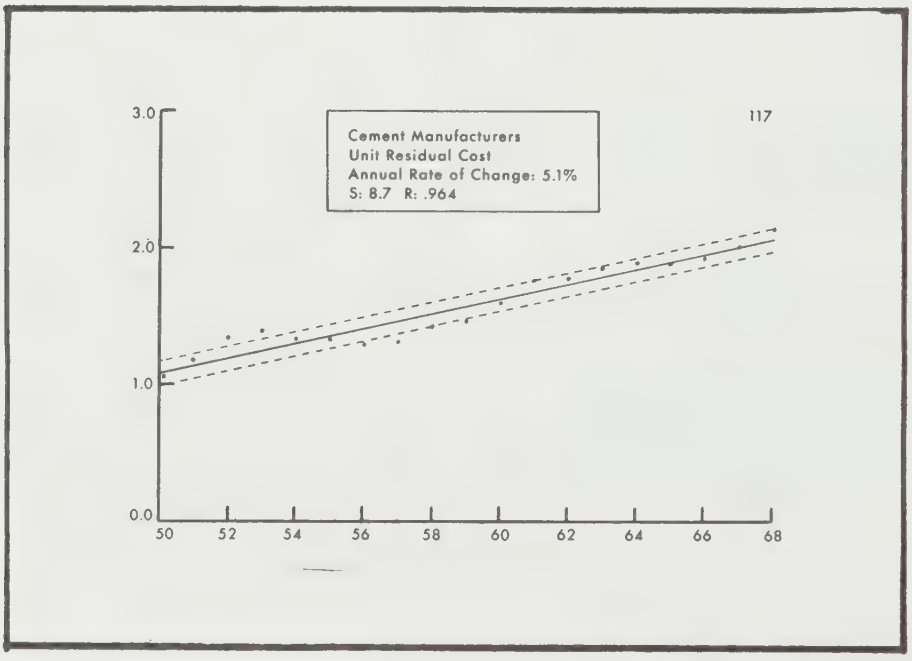
Summary Table – Principal Statistics

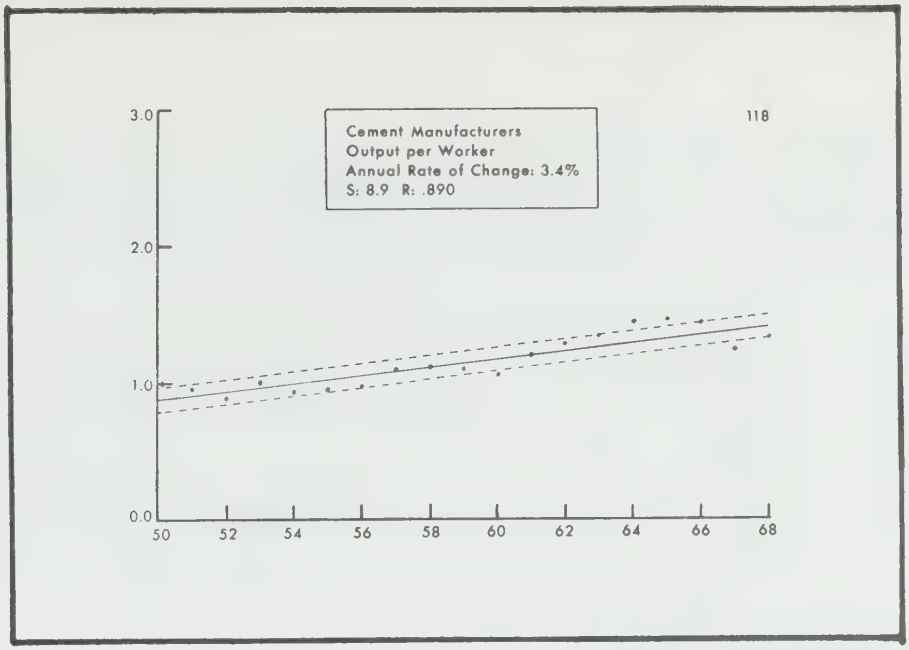
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			249.7			114.9			
Index of value added (1949 or 1961 = 100)			508.5			140.1		138.3	
Index of employment (1949 or 1961 = 100)	155.5	187.7		97.9	104.4				
Index of compensation per worker (1949 or 1961 = 100)	259.0	269.4		140.1	139.4				
Annual trend rate, compensation per worker	+7.4%	+8.1%		+6.1%	+5.6%				
Implicit, value-added price – index, 1949 or 1961 = 100			203.6			121.9		120.3	
– Annual trend rate of change			+4.1%			+3.3%		+3.2%	
– R value			.960			.939		.934	
Output per worker – index, 1949 or 1961 = 100	160.6	133.0		117.4	110.1				
– Annual trend rate of change	+5.5%	+3.4%		+0.9%	–0.2%				
– R value	.944	.890		.316	.072				
Unit labour cost – index, 1949 or 1961 = 100	161.3	202.5		119.3	126.6				
– Annual trend rate of change	+0.9%	+2.7%		+5.0%	+6.1%				
– R value	.475	.833		.841	.847				
Unit residual cost – index, 1949 or 1961 = 100	214.9	204.0		122.5	120.6		118.7		
– Annual trend rate of change	+5.1%	+4.5%		+2.9%	+2.6%		+2.4%		
– R value	.964	.950		.930	.932		.936		
Payroll as a proportion of value added 1949	20.9%	22.8%							
1961				16.9%	21.8%		21.7%		
1968	16.5%	22.7%					22.8%		
Trend rate of change in labour share	–1.8%	–0.7%		+1.4%	+2.2%		+2.4%		
– R value	.866	.501		.498	.641		.675		
Trend rate of change in residual share	+0.5%	+0.2%		–0.3%	–0.6%		–0.6%		

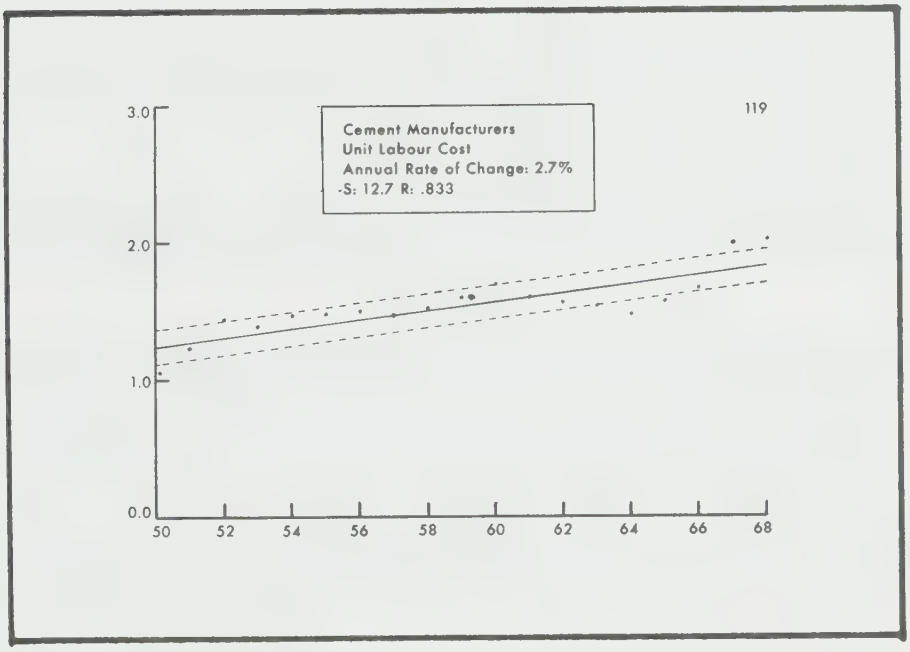
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

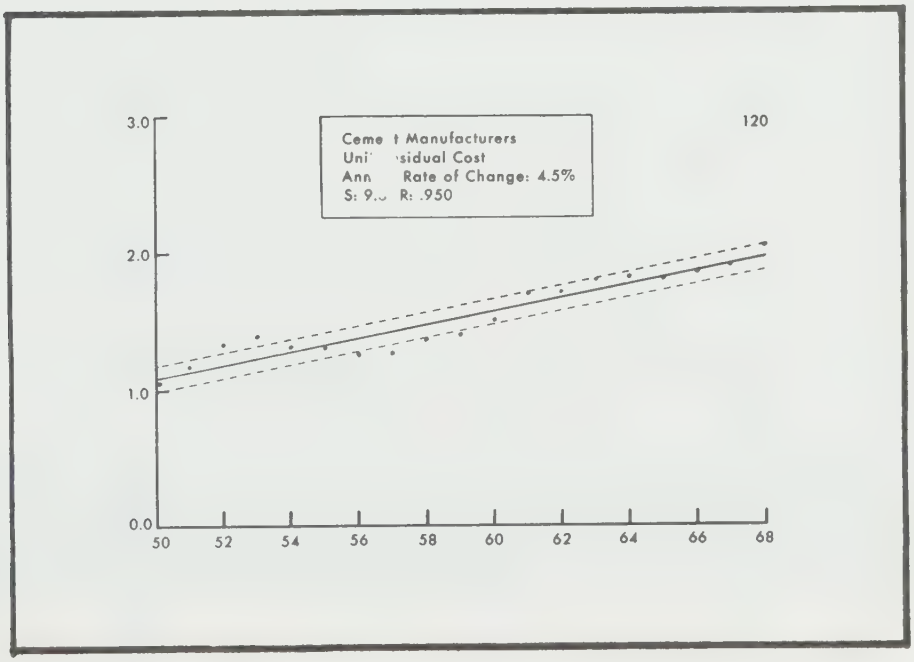

115
Cement Manufacturers
Output per Worker
Annual Rate of Change: 5.5%
S: 9.5 R: .944
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


116
Cement Manufacturers
Production Labour
Unit Labour Cost
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


117
Cement Manufacturers
Unit Residual Cost
Annual Rate of Change: 5.1%
S: 8.7 R: .964
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


118
Cement Manufacturers
Output per Worker
Annual Rate of Change: 3.4%
S: 8.9 R: .890
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


119
Cement Manufacturers
Unit Labour Cost
Annual Rate of Change: 2.7%
S: 12.7 R: .833
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


120
Cement Manufacturers
Unit Residual Cost
Annual Rate of Change: 4.5%
S: 9.0 R: .950
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

Annual wages and salaries per worker increased more than annual wages in the full period and less in the short period. For total labour the 1949-1968 increase of 169.4 percent was close to the 166.5 percent for all manufacturing, and the annual trend rate of increase of 8.1 percent, a little more than the 7.4 percent for production labour, was also somewhat greater than the average of 7.5 percent. The 39.4 percent increase between 1961 and 1968 was about 15 percent less than the 45.9 percent for all manufacturing and the annual trend rate of increase, at 5.6 percent, was 11 percent less than the 6.3 percent average.

Implicit (value-added) price rose much more than average over both the full and short periods, although the rate of increase diminished somewhat over the short period. The rise of 103.6 percent between 1949 and 1968 was more than three times the average increase of 33.0 percent (see Table 12). The annual trend rate of increase of 4.1 percent was more than four times the average rate of 1.0 percent and the second highest rate among the industries studied (see Table 16). The 21.9 percent increase between 1961 and 1968 was 3 1/2 times the average increase of 6.2 percent, while the annual trend rate of increase of 3.3 percent was 3 2/3 times the rate of 0.9 percent for all manufacturing. However, over this more recent period seven other industries had higher rates of increase. The difference between this industry and all manufacturing was not quite as great for implicit price with respect to value added by total activity as it was with respect to value added by manufacturing activity. The increase of 20.3 percent between 1961 and 1968 with respect to value added, total was about the same as the 21.9 percent with respect to value added, manufacturing, and was twice the 10.5 percent increase for all manufacturing (compared with 3 1/2 times described just above). The trend rate of 3.2 percent was almost the same as the 3.3 percent discussed above but was less than twice the average rate of 1.7 percent (compared with 3 2/3 times described above).

The industry selling price index moved up 16.3 percent between 1961 and 1968, compared with 21.9 percent and 20.3 percent for the two implicit price indexes. Since industry selling price resembles wholesale price, it means that it reflects the cost of raw materials, fuel and energy inputs which are not part of implicit (value-added) price. Since industry selling price increased significantly less than value-added price, it follows that relatively lower costs of the inputs just described modified the effect of the more rapidly increasing value-added price.

Labour productivity increased less than average in this industry over both the full and the short periods. While there was a well-fitting trend over the full period, the trend in the short period had no significance. This appears to be because of certain movements that tend to fit a linear regression over the full period but suggest some kind of curvilinear function over the more recent years, which can be observed from the charts.[36]

Output per production worker in 1968 was 60.6 percent greater than in 1949, little better than half the average increase (see Table 17). The annual trend rate of increase of 5.5 percent was not as much below average as the 1949-1968 difference, being only seven percent less than the rate of 5.9 percent for all manufacturing. This higher rate than might be expected reflects the stronger increases from 1960 to 1965, amounting to 40 percent altogether, while the 12 percent drop from 1965 to 1967 combined with the period of little net change between 1949 and 1956 to keep the rate less than average. However, seven of the industries studied had smaller rates of increase.

Between 1961 and 1968 there was little net change. While the 1968 index was 17.4 percent above the 1949 value, there was steady increase from 1961 to 1965, amounting to 25 percent, followed by a 12 percent reduction over the next two years (noted above) and a seven percent rise in the last year. The linear trend rate of increase of 0.9 percent has no statistical significance.[37]

Output per worker with respect to total labour increased less than with respect to production labour only. Over the full period the increase was 33.0 percent, hardly more than half the increase for production labour, and one-third of the 103.7 percent increase in all manufacturing. This measure also followed movements similar to those for production labour (see the chart and Table 17). The trend rate of increase of 3.4 percent per annum was 60 percent of the 5.5 percent for production labour alone and was just short of 60 percent of the 5.8 percent rate for all manufacturing. As with production labour only, there was no significant linear trend over the short period, the indexes (with base 1961) ranging from a low of 100.0 in 1961 to a high of 120.8 in 1965, with the average over the eight years being 111.2. The fact that the 1967 value was only 3.0 percent higher than in 1961 combined with the variations just described to produce a "no-change" trend.

With respect to production labour, three of the other industries studied had trend rates of increase over the short period of less than one percent, all of which were statistically significant, at least at the 95 percent level, and there was one such industry with respect to total labour (see Table 19).

In view of the relatively low increases in output per worker and the average increases in compensation per worker in this industry, it is to be expected that unit labour cost increases would be greater than average. This was in fact the case.

For production labour the increase over the full period was 61.3 percent, some 2 2/3 times the increase of 23.0 percent in all manufacturing (see Table 24). The annual trend rate of increase of 0.9 percent was 80 percent greater than the average rate of 0.5 percent. Five industries had greater rates of increase, while eleven industries showed declining unit labour costs over this period (see Table 26). Between 1961 and 1968 the increase was 19.3 percent, 2 3/4 times the increase of 6.9 percent in all manufacturing, while the trend rate of increase, at 5.0 percent per annum, was not only much greater than the full-period

rate (on the average this was the case among manufacturing industries) but was 2 1/2 times the short-period rate of 2.0 percent for all manufacturing. Only one industry among those studied had a higher rate over this period.

The increases relative to total labour were greater than those relative to production labour, and as with the latter they were greater over the short than over the full period. Between 1949 and 1968 the increase was 102.5 percent, 3 1/3 times the 30.8 percent rise for all manufacturing. The annual trend rate of increase of 2.7 percent was three times the rate for production labour and almost four times the rate of 0.7 percent in all manufacturing. Three industries had higher rates of increase (see Table 26). Between 1961 and 1968 there was a rise of 26.6 percent, half again as much as the 17.6 percent rise in all manufacturing. The trend rate of 6.1 percent exceeded by more than 20 percent that for production labour only and by almost 3 1/4 times the rate for all manufacturing. This was the highest rate of increase for any of the industries studied.

While unit labour cost relative to production labour showed a statistically significant linear trend at the 95 percent level, a nonlinear regression increased the significance to the 99 percent level (see Appendix C). The curvilinear trend line is plotted for this series in the accompanying chart.

This has been an industry of rising unit costs of production, both labour and residual. Over the full period unit residual cost increased considerably more than unit labour cost, while over the shorter period the reverse was the case. However, over both periods, unit residual cost increased more with respect to production than total labour. This is to be expected because nonproduction labour cost is part of the measure related to production but not to total labour and we know that nonproduction labour cost was increasing more than production labour cost because unit labour cost relative to production labour only increased less than unit labour cost for total labour which, of course, includes nonproduction labour.

Over the full period the increase with respect to production labour was 114.9 percent, almost three times the increase of 38.9 percent for all manufacturing (see Table 28). The annual trend rate of increase was 5.1 percent, close to six times the rate for unit labour cost and almost four times the rate of 1.3 percent in all manufacturing. Only one industry among those studied had a higher rate over this period (see Table 31). Over the short period the increase was 22.5 percent, almost four times the 5.8 percent for all manufacturing. The trend rate of increase was 2.9 percent, a little more than half the rate for unit labour cost (a reverse from that for the full period), exceeded by the rates for seven of the industries studied, and to be compared with a situation of no net change for all manufacturing.

With respect to total labour the increase over the full period was 104.0 percent, about three times the 35.1 percent for all manufacturing. The annual trend rate of increase, at 4.5 percent, was rather less than the 5.1 percent relative to production labour and two-thirds more than the rate for unit labour cost; it was 3 3/4 times the rate for all manufacturing and was exceeded in only one industry. Over the short period the increase was 20.6 percent, compared with a slight decrease in all manufacturing. The trend rate of increase was 2.6 percent per annum, less than half the rate for unit labour cost; nine of the industries studied showed greater rates of increase in this measure of unit residual cost over the short period (see Table 31) and, as with respect to the measure related to production labour, there was no net change for all manufacturing. For unit residual cost relative to total labour and to value added by total activity, the 1961-1968 percentage change and the trend rate were similar to those described relative to value added by manufacturing, except that the 2.4 percent for this industry compared with 1.6 percent for all manufacturing, rather than no net change, as in the case of the other measures.

This was one of the least labour intensive of all the industries studied. The production labour share of value added was 20.9 percent in 1949, 16.9 percent in 1961 and 16.5 percent in 1968. Only three of the industries showed a smaller labour share in 1949, and it was about 40 percent less than the labour share in all manufacturing. The total labour share was not much larger in 1949 than the production labour share, 22.8 percent, compared with 20.9 percent, but because of the substantial shift away from production labour, described earlier in this section, by 1968 there was a greater difference between the two shares, 22.7 percent for total labour, 16.5 percent for production labour. The shares of total labour relative to value added, total activity were much the same as those relative to value added by manufacturing.

With shares as small as these, trend rates of change are not likely to mean very much, especially when, as in this industry, the full-period trends show a fall in the labour shares and the short-period trends show an increase. This industry seems to follow certain long-term cyclical movements, which have been given very brief reference in this section, and the labour share probably behaves similarly.

The composition of implicit (value-added) price change for cement manufacturers is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.9	x	.209)	+	(5.1	x	.791)	=	4.2	4.1
Tot. lab., 1949-68[x]	(2.7	x	.228)	+	(4.5	x	.772)	=	4.1	4.1
Prod. lab., 1961-68[x]	(5.0	x	.169)	+	(2.9	x	.831)	=	3.3	3.3
Tot. lab., 1961-68[x]	(6.1	x	.218)	+	(2.6	x	.782)	=	3.4	3.3
Tot. lab., 1961-68[y]	(6.1	x	.217)	+	(2.4	x	.783)	=	3.2	3.2

x – related to value added manufacturing
y – related to value added total activity
A – as calculated from this equation
B – as calculated by computer (see Table 16)

Because the residual weight is so much greater than the labour weight, unit residual cost has been the principal component of implicit price change, even when the rate of change in unit labour cost is much greater than the rate for unit residual cost. In the first equation unit labour cost accounts for only 4.5 percent of price change $\left(\frac{0.9 \times .209}{4.2}\right) = .045$.

The percentages for the four other equations are, in order: 15.0, 25.6, 37.3, and 41.4. If unit labour cost had not moved up or down, implicit price would have changed at the rate shown for unit residual cost. In the first two equations covering the full period unit labour cost had a moderating influence and in the last three, the opposite effect. Once more it must be emphasized very strongly that the reference here is to *the mathematical influences* of each component of the result of the equation; it is not meant to imply that the costs pushed the price up - which they may or may not have done - since the price may have been pulled up by demand factors - which may or may not be the case - influencing factor prices and factor costs in turn.

A report has recently been published by Statistics Canada on productivity in the cement manufacturing industry.[38] Like other studies in this series, it includes much more detailed information on the industry than is found in our study, and it is one of the first in the series to include data on unit labour cost. It should be pointed out that the estimates of output per worker and of labour cost per unit of output are much the same in the Statistics Canada study and this one, which is to be expected since they both use the same basic data. The reader wanting greater detail about the industry for the years, 1959 to 1969, will want to consult this other study; however, it does not contain estimates of unit residual cost or implicit (value-added) price which are found in our study.

Petroleum and coal products

This industry, particularly the petroleum refining part of it, is changing its trade orientation so that the data on exports and imports compiled for this study on an industry basis from commodities data may not accurately reflect more recent conditions. However, on the basis of 1965 data, exports accounted for only 1.6 percent of the value of production and imports accounted for 10.0 percent of the value of total market sales of products of the industry. It is primarily a domestic industry, supplying the needs of industry, commerce and the consumer. Part of its importance to the consumer can be assessed by the fact that 1.7 percent of the consumer price index covers fuel oil and 2.6 percent, gasoline for automobiles. The products of this industry are included in many other items measured by the consumer price index.

The petroleum and coal products industries (called an industry here, for ease of presentation) comprise: petroleum refineries (Standard Industrial Classification code 365) which are establishments primarily engaged in refining crude petroleum and producing gasoline, fuel oils, lubricating oils, illuminating oils, as well as the blending of lubricating oils and greases purchased from elsewhere; and other petroleum and coal products industries (S.I.C. code 369) covering the manufacture of petroleum and coal products not elsewhere classified, such as fuel briquettes, road emulsions, and roofing compounds, as well as coking plants operated as separate activities and not subsidiary to iron and steel or chemical plants. While some changes were made in the revision of the S.I.C. in 1960 involving the transfer to certain products or activities to other industries, it is possible to maintain a continuous series by the use of the adjustment factors set forth in Appendix A.

Over the full period, production in this industry increased more than average — only four of the industries studied had greater increases — and the rise in value added was the second greatest among the industries. However, over the more recent, short period both increases were less than average. Production in 1968 was 279.6 percent greater than in 1949, almost two-thirds more than the increase of 170.6 percent in all manufacturing (see Table 2). The rise of 566.6 percent in value added over the same period was more than twice the rise of 259.9 percent for all manufacturing. The increase of 35.9 percent between 1961 and 1968 fell by more than 40 percent behind the average increase of 61.1 percent, but eight industries among those studied showed smaller increases. The increase of 13.7 percent in value added, manufacturing over this period was almost matched by one industry but no industry in the group studied showed a smaller increase, which was less than one-fifth of the 71.0 percent increase in all manufacturing. Only one industry registered a smaller increase in value added, total activity and the 16.0 percent increase was one-fifth of the 78.1 percent average.

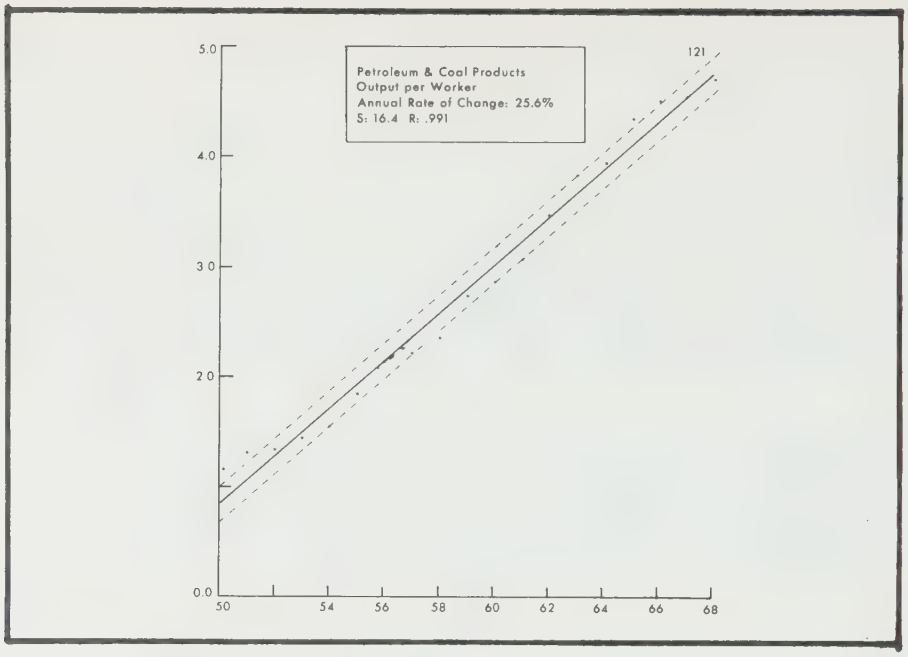
Employment declined for both categories of labour over both the full and short periods, much more for production than total labour over the full period, but to about the same extent for both over the short period. Between 1949 and 1968 production labour employment dropped 19.4 percent, compared with an increase of 27.2 percent for all manufacturing (see Table 3). Between 1961 and 1968 the reduction was 11.4 percent while there was an increase of 19.7 percent in all manufacturing. For total labour there was a slight drop of 2.1 percent between 1949 and 1968, while in all manufacturing there was a rise of 32.8 percent; between 1961 and 1968 the reduction was 13.6 percent while in all manufacturing there was a 29.8 percent increase. Over the full period the proportion of production labour to total employment dropped substantially from

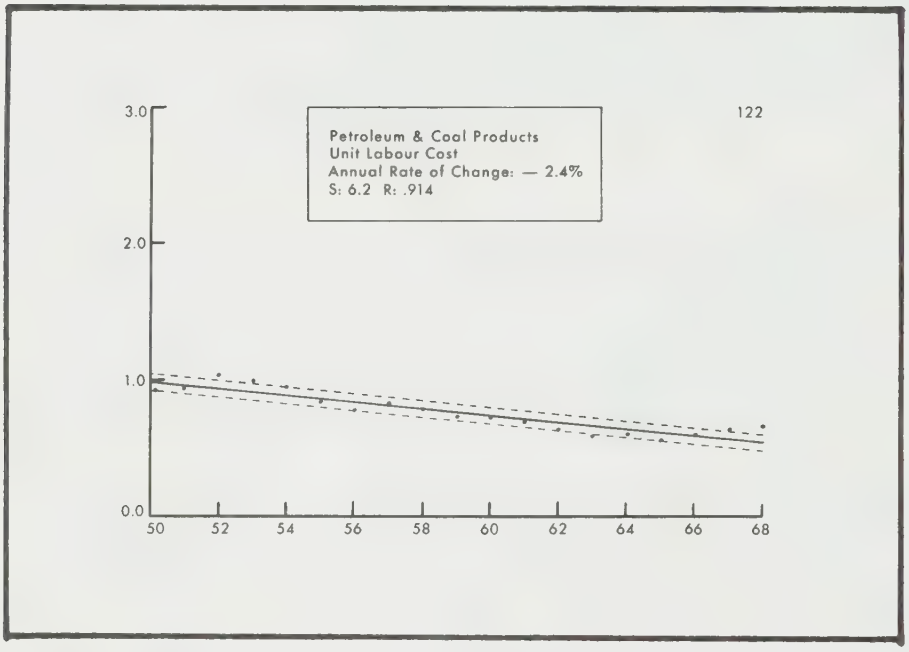
PETROLEUM AND COAL PRODUCTS

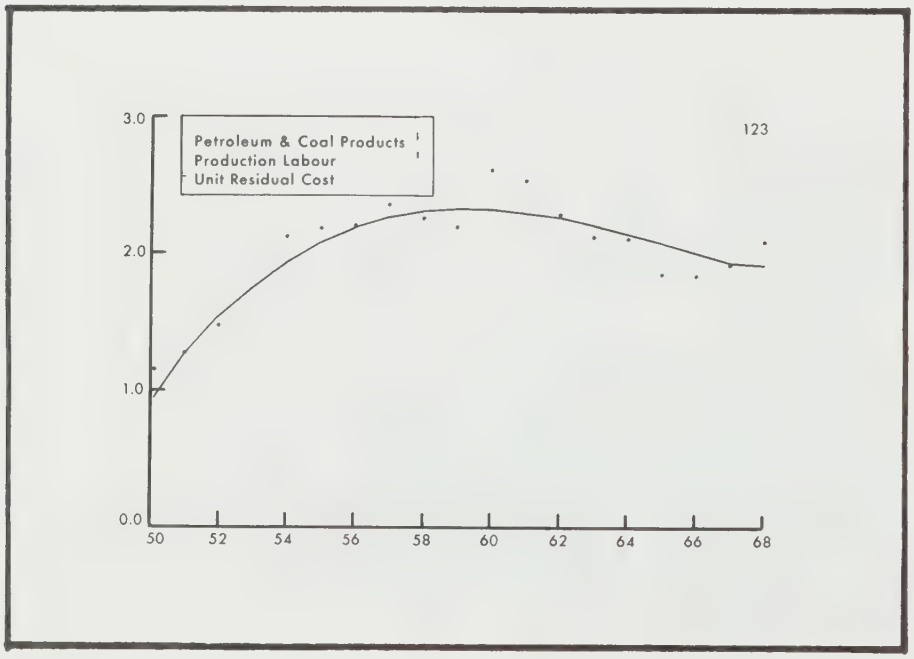
Summary Table — Principal Statistics

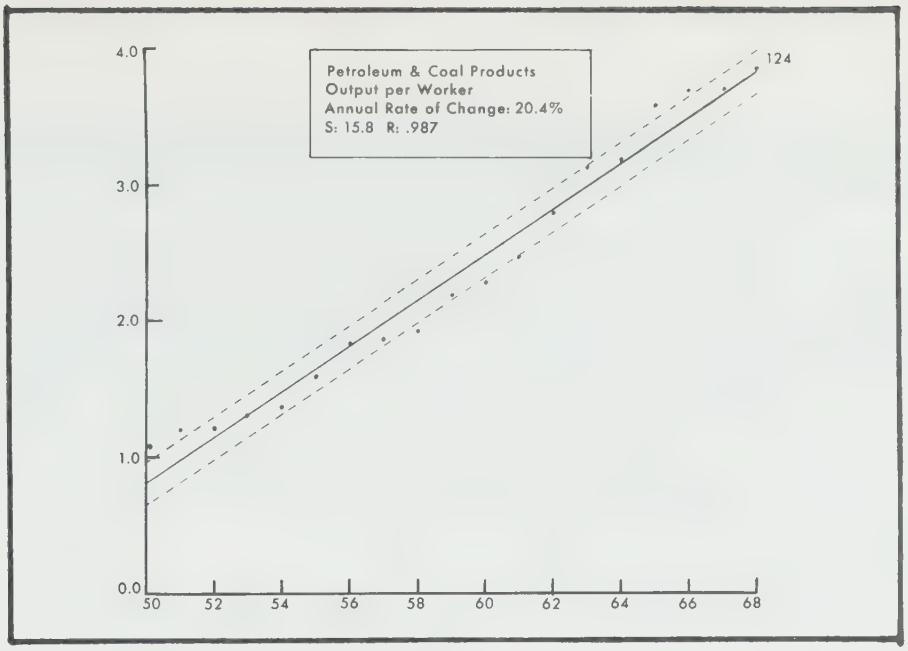
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			379.6			135.9			
Index of value added (1949 or 1961 = 100)			666 6			113.7		116.0	
Index of employment (1949 or 1961 = 100)	80.6	97.9		88.6	86.4				
Index of compensation per worker (1949 or 1961 = 100)	313.4	301.9		148.7	138.5				
Annual trend rate, compensation per worker	+9.4%	+9.8%		+7.4%	+6.3%				
Implicit, value-added price — index, 1949 or 1961 = 100			175.6			83.7		85.3	
— Annual trend rate of change			+1.5%			−1.7%		−1.5%	
— R value			.406			.526		.487	
Output per worker — index, 1949 or 1961 = 100	471.2	384.9		153.5	156.2				
— Annual trend rate of change	+25.6%	+20.4%		+5.7%	+6.0%				
— R value	.991	.987		.972	.961				
Unit labour cost — index, 1949 or 1961 = 100	66.5	78.4		96.8	88.6				
— Annual trend rate of change	−2.4%	−1.8%		+1.0%	+0.1%				
— R value	.914	.895		.376	.054				
Unit residual cost — index, 1949 or 1961 = 100	209.5	225.2		82.6	82.8		83.8		
— Annual trend rate of change	+2.2%	+2.6%		−2.6%	−2.6%		−2.3%		
— R value	.483	.504		.666	.592		.553		
Payroll as a proportion of value added 1949	23.7%	33.8%							
1961				7.8%	14.2%		33.7%		
1968	9.0%	15.9%					35.0%		
Trend rate of change in labour share	−3.7%	−3.1%		+3.0%	+2.0%		+1.8%		
— R value	.786	.768		.890	.641		.604		
Trend rate of change in residual share	+0.7%	+2.6%		−1.0%	−1.1%		−0.9%		

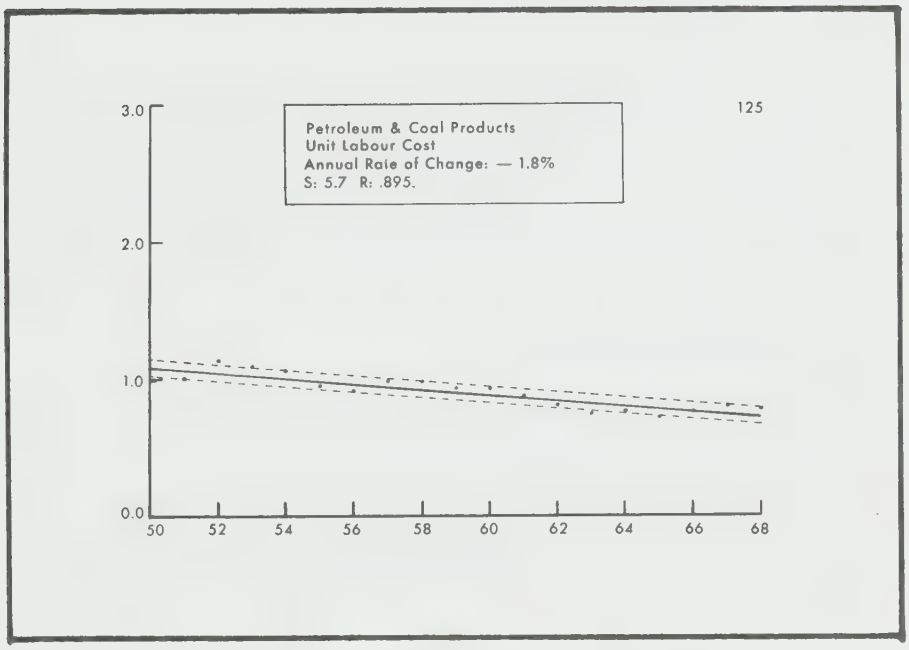
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

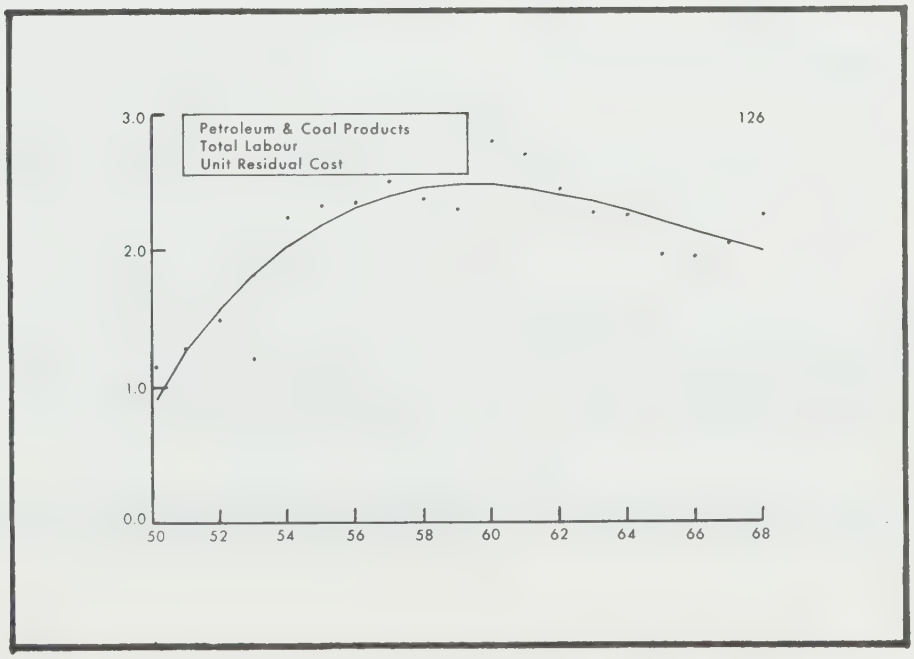

Petroleum & Coal Products
Output per Worker
Annual Rate of Change: 25.6%
S: 16.4 R: .991
121
5.0
4.0
3.0
2.0
0.0
50
54
56
58
60
62
64
66
68


Petroleum & Coal Products
Unit Labour Cost
Annual Rate of Change: — 2.4%
S: 6.2 R: .914
122
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Petroleum & Coal Products
Production Labour
Unit Residual Cost
123
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Petroleum & Coal Products
Output per Worker
Annual Rate of Change: 20.4%
S: 15.8 R: .987
124
4.0
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Petroleum & Coal Products
Unit Labour Cost
Annual Rate of Change: — 1.8%
S: 5.7 R: .895.
125
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Petroleum & Coal Products
Total Labour
Unit Residual Cost
126
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

73.6 percent in 1949 to 59.7 percent in 1967 (a 1968 figure not being available at the time the data were compiled). Only one industry had a smaller production worker proportion at the end of the time period (see Table 5). There was a strong trend rate of decrease of -1.0 percent per annum, matched by one industry and exceeded by only one.

Compensation (annual wages, annual wages and salaries) per worker increased by more than average over both time periods for production labour, and for total labour, more than average over the full period and at the average rate over the short period. The increase in annual wages per production worker between 1949 and 1968 of 213.4 percent was one-third more than the increase of 161.5 percent for all manufacturing. The annual trend rate of increase of 9.4 percent was also about one-third more than the 7.2 percent for all manufacturing and was exceeded by the rate for only two of the industries studied (see Table 11). From 1961 to 1968 the increase was 48.7 percent, 11 percent more than the 43.9 percent in all manufacturing, while the trend rate of 7.4 percent was about one-sixth greater than the 6.3 percent average and was exceeded in only two of the other industries. Annual wages per worker increased more than average hourly earnings over both periods which in turn increased more than occupational wages rates; from 1949 to 1968 the respective increases were 213.4, 195.1, and 173.1 percent, and from 1961 to 1968, they were 47.1, 41.3, and 39.3 percent (see Table 9A). Possible reasons for these differences are set forth in general terms in the section on wages in Chapter Six.

Annual wages and salaries per worker rose 201.9 percent over the full period, one-fifth more than the average increase of 166.5 percent, and the annual trend rate of increase of 9.8 percent was not only a little greater than the 9.4 percent for production labour but almost one-third greater than the 7.5 percent for all manufacturing. Only one of the industries had a higher rate (see Table 11). However, form 1961 to 1968 the increase was 38.5 percent, about one-sixth less than the 45.9 percent for all manufacturing, and the annual trend rate was 6.3 percent, significantly less than the 7.4 percent for production labour, but right in line with the 6.3 percent for all manufacturing.

Implicit (value-added) price moved up during the 1950's and down during the 1960's but not enough to reach the same level as at the beginning of our time period (see Table 12). Between 1949 and 1968 there was a 75.6 percent rise, about 2 1/3 times the increase of 33.0 percent in all manufacturing; the annual trend rate of increase of 1.5 percent (significant at the 95 percent level) was 50 percent above the 1.0 percent for all manufacturing, but was exceeded in seven of the other industries and matched in one (see Table 16). The reverse trend actually began between 1960 and 1961 but since this study regards 1961-1968 as one time period, it should be observed that over this short period there was a drop of 16.3 percent while in all manufacturing there was a rise of 6.2 percent. The annual trend rate of decrease was -1.7 percent (almost significant at the 99 percent level), to be compared with an average rate of increase of 0.9 percent. Four other industries showed a downtrend, two of them at greater rates (see Table 16). Implicit price with respect to value added by total activity behaved in much the same way (see the summary table of statistics).

The industry selling price index for the petroleum and coal products industries moved down 1.9 percent between 1961 and 1968, compared with reductions of 16.3 and 14.7 percent over the same period in implicit price relative to value added by manufacturing activity and by total activity. The industry selling price index is a kind of wholesale price index on an industry rather than commodity base and reflects the cost of raw material and other inputs which are not covered by the value-added price index. Since value-added price fell much more than industry selling price, the cost of inputs from outside the establishment was the likely reason. The consumer (retail) price index for fuel oil declined 5.0 percent over this period, while gasoline for automobiles experienced a 15.3 percent price rise. This latter increase may reflect increased costs or profits at the retail distribution level and/or higher taxes.

Labour productivity increased more in this industry over the full period than in any other industry studied, and while the increase continued to be greater than average over the short period, it was no longer the largest.

Between 1949 and 1968 output per production worker increased 371.2 percent, which was 3 1/3 times the rise of 112.7 percent in all manufacturing (see Table 17). The annual trend rate of increase was 25.6 percent, the highest rate for any industry (see Table 19), and 4 1/3 times the rate of 5.9 percent in all manufacturing. The increase between 1961 and 1968 was 53.5 percent, slightly more than 50 percent higher than the 34.6 percent for all manufacturing, and the trend rate of increase of 5.7 percent was also slightly more than 50 percent above the average rate of 3.7 percent; however, three industries showed higher rates over this short period.

With respect to total labour, output per worker increased less than for production labour over the full period and a little more over the short period. From 1949 to 1968 the increase was 284.9 percent, 2 3/4 times the increase of 103.7 percent for all manufacturing; the trend rate of increase of 20.4 percent per annum, while somewhat less than the 25.6 percent for production labour, was 3 1/2 times the average rate of 5.8 percent and the highest rate for any of the industries studied. Between 1961 and 1968 the increase was 56.2 percent, 2 1/3 times the 24.1 percent for all manufacturing. The annual trend rate of increase of 6.0 percent was a little more than the 5.7 percent for production labour only and more than 1 1/2 times the rate of 3.9 percent for all manufacturing; three industries had greater rates of increase.

Unit labour cost moved downward over the 1950's but settled into a position of little net change over the short period. Unit cost of production relative to production labour was 33.5 percent less in 1968 than in 1949, compared with an increase of 23.0 percent in all manufacturing (see Table 24). There was an annual trend rate of decrease of -2.4 percent, while for all

manufacturing there was a rate of increase of 0.5 percent. Ten other industries showed rates of decrease but none exceeded the rate for this industry (see Table 26). Between 1961 and 1968 there was no net change; with 1961 as the base, the indexes varied from a high of 100.0 in 1961 to a low of 80.9 in 1965 and averaged 90.7; the trend rate was for an annual increase of 1.0 percent but was not significant even at the 95 percent level (R = .376; see Appendix C).

Relative to total labour, unit labour cost was 21.6 percent less in 1968 than in 1949, while in all manufacturing there was an increase of 30.8 percent. There was an annual trend rate of decrease of -1.8 percent, not as great as the -2.4 percent with respect to production labour, but greater than for any of the nine other industries with decreasing unit labour cost and to be compared with a rate of increase of 0.7 percent for all manufacturing. Over the short period there was even less indication of an upward or downward trend than there was with respect to production labour.

Unit residual cost moved along a curvilinear trend, as illustrated in the charts accompanying this section, tending to move up in the 1950's and down in the 1960's.[39] Unit residual cost relative to production labour was 109.5 percent higher in 1968 than in 1949, close to three times the difference of 38.9 percent for all manufacturing (see Table 28). The annual trend rate of increase was 2.2 percent, almost 70 percent more than the average rate of 1.3 percent. Four of the other industries had greater rates and one had the same (see Table 31). Between 1961 and 1968 there was a decrease of 17.4 percent and a trend rate of decline of -2.6 percent per annum; of the six other industries showing decreases only two had a greater rate, while in all manufacturing there was a situation of no net change.

With respect to total labour the increase over the full period was a little greater than for production labour only, but moved downward over the short period at about the same rate. The increase between 1949 and 1968 was 125.2 percent, more than 3 1/2 times the average increase of 35.1 percent. The annual trend rate of increase was 2.6 percent, somewhat more than the 2.2 percent relative to production labour only, and more than twice the rate of 1.2 percent for all manufacturing; four of the industries studied showed greater rates of increase (see Table 31). As with the measure relative to production labour, the trend shifted downward between 1961 and 1968, the index in 1968 being 17.2 percent below the 1961 level, and with a trend rate of decrease of -2.6 percent per annum, the same as with respect to production labour; five other industries showed a rate of decrease, one at the same rate as for petroleum and coal products, two of them at a greater rate, while in all manufacturing over this period there was no net change. Unit residual cost relative to total labour and value added by total activity also declined during the 1961-1968 period, but somewhat less than the measure related to value added by manufacturing, as the summary table of statistics indicates.

The labour share was one of the lowest in this industry even in 1949 - four industries had lower production and total labour shares - and in 1968 both shares were smaller than in any of the other industries studied (see Table 34). However, as we have already observed in other respects, there was a shift around the end of the 1950's and the beginning of the 1960's. There was a rather steady decline until 1961 followed by an equally steady rise thereafter in both the production and total labour shares. Nevertheless, the net result was greatly reduced labour share by 1968 compared with 1949.

The production labour share declined from 23.7 percent in 1949 to 9.0 percent in 1968, a drop of more than 60 percent, following an annual trend rate of -3.7 percent; while 15 of the industries showed rates of decline, none were as great as this (see Table 36) and it is to be compared with -0.4 percent for all manufacturing. However, the share did increase from 7.8 percent in 1961 to 9.0 percent in 1968, and the annual trend rate of increase was 3.0 percent. The total labour share moved down from 33.8 percent in 1949 to 15.9 percent in 1968, a reduction by one-half, with an annual trend rate of decrease of -3.1 percent which, as in the case of production labour, was the largest rate of decrease among the 14 indicated. Similarly, the share moved up from 14.2 percent in 1961 to 15.9 percent in 1968, an annual trend rate of increase of 2.0 percent. The total labour share of value added, total activity was much larger than the share of value-added manufacturing, which was the case in a few other industries as well but in none as noticeably as in petroleum and coal products, because value added, total activity in this industry was less than value added by manufacturing.[40] The share in 1961 was 33.7 percent and in 1968, 35.0 percent, also showing an increase.

The shift from a declining to a slightly increasing labour share should not be exaggerated in view of the large reduction over the 20 years; nevertheless, it reflects the shift in all the series for this industry. There was a decided drop in the rate of increase in output per worker, a change from declining to relatively stable unit labour cost, from rising to falling unit residual cost, and from rising to falling implicit (value-added) price.

The rapid changes in the labour share, which serves as the labour weight in computations of changes in unit residual cost and residual share of value added, means that current-weighted computations will produce quite different results from those that are base-weighted which have been used in this study. The interested reader may obtain on request from the Canada Department of Labour, Economics and Research Branch, a comparison of change in the residual share computed on the two bases.

The composition of implicit (value-added) price change for petroleum and coal products is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-2.4	x	.237)	+	(2.2	x	.763)	=	1.1	1.5
Tot. lab., 1949-68[x]	(-1.8	x	.338)	+	(2.6	x	.662)	=	1.1	1.5
Prod. lab., 1961-68[x]	(1.0	x	.078)	+	(-2.6	x	.922)	=	-2.3	-1.7
Tot. lab., 1961-68[x]	(0.1	x	.142)	+	(-2.6	x	.858)	=	-2.2	-1.7
Tot. lab., 1961-68[y]	(0.1	x	.337)	+	(-2.3	x	.663)	=	-1.5	-1.5

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

It will be observed that the values in columns A and B are significantly different for the first four equations. This is because the values in column A are the direct result of the equations while those in column B were computed by least squares from the actual implicit (value-added) price indexes for each year observed. Ordinarily, when unit cost follows a well-fitting linear trend in each case and provided that implicit price does likewise, the values in A and B should not be very different. However, it will be seen from the R values in the summary table of statistics that the trend rates for unit labour cost in the short period were not significant at the 95 percent level (see Appendix C for an explanation) and only two of the other trend rates were significant at the 99 percent level. When the R values are squared and multiplied by 100 to produce an index of determination, it can be seen that, in the case of the implicit (value-added) price trend for the full period, $R^2 = 16.5$, meaning that only 16.5 percent of the price change can be associated with the passage of time (measured in years). In some cases, as with unit residual cost, the trend over the full period is nonlinear, which may also be true for some of the other series also (computations were only made for a few of the measures by way of a test). It can be understood that the product of equations embodying trend rates of change of imperfect statistical significance may differ from a trend rate derived from the actual values. (For a fuller, technical explanation, see Appendix B.)

The foregoing notwithstanding, it is only possible to discuss a trend rate, expressed as a kind of average annual change, in linear terms since the computed value for each year under any kind of nonlinear trend will differ by more than a constant amount. Furthermore, it happens that the trend values without any statistical significance are for unit labour cost over the short period; combined with the very low labour weights in the last three equations, it means that in the third equation unit labour cost made a difference of only one-tenth (0.1) of one percent, and in the fourth and fifth equations it didn't even make that much difference. This means that in effect over the short period unit labour cost constituted neither a plus nor minus component of implicit price change and all of the declining implicit price must be associated with declining unit residual cost.

However, in the first two equations, unit labour cost is more important as a component and it happens that the trend rates of change are of considerable statistical significance ($R = .914$ for the first equation and .895 for the second). In both equations the labour component constitutes -0.6 percent, meaning that, in their absence implicit price would have been increasing at a rate of 1.7 percent rather than 1.1 percent.

To conclude this section, the reader's attention should be drawn to a report recently published by Statistics Canada on productivity from 1959 to 1969 in petroleum refineries.[41] As with other studies in this series, it contains much detailed information that our study does not provide. The Statistics Canada Report covers petroleum refineries only, which makes it a more homogeneous unit for analysis than petroleum and coal products covered here. But our study could only cover the 1949-1968 period on the basis of the larger industry grouping. For that reason, data on productivity and unit labour cost are not the same in the two studies. The interested reader will want to consult the Statistics Canada report; however, it does not contain estimates of unit residual cost or of implicit (value-added) price which are found here.

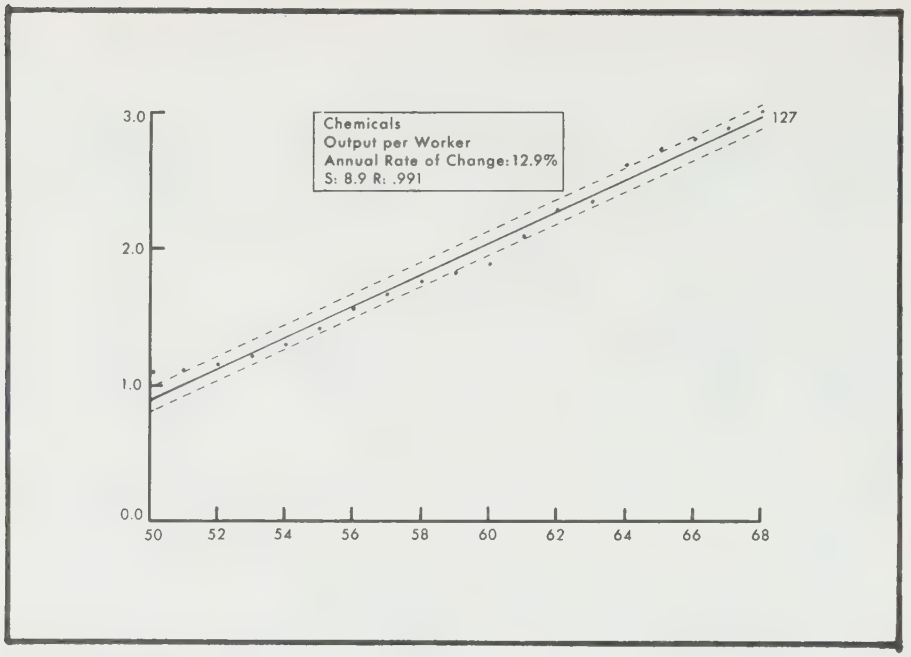
Chemicals

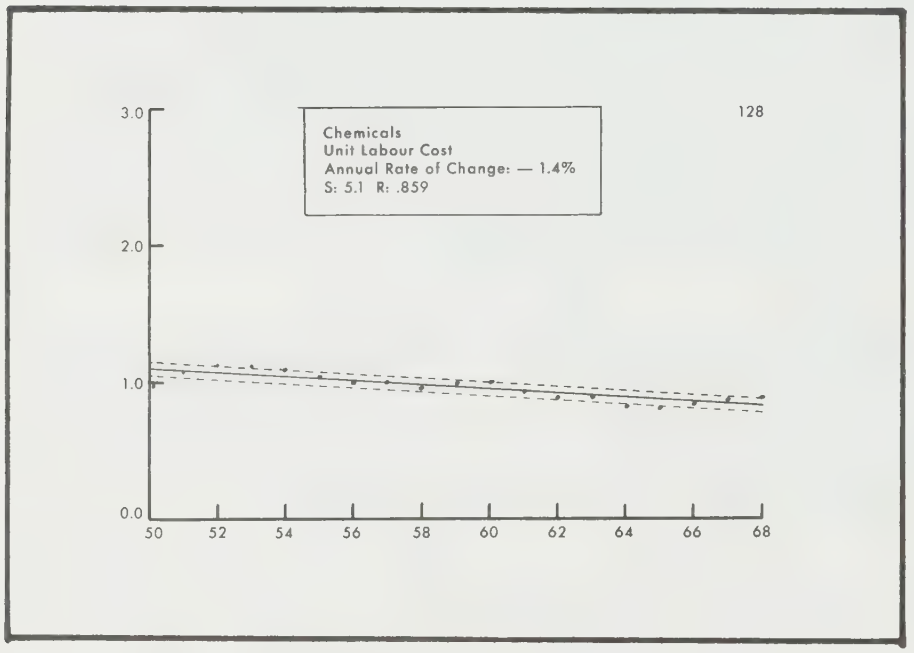
Foreign trade has been important in this industry group. According to data compiled for 1965 on an industry basis for this study from commodities data, exports constituted 34.6 percent of the value of the industry's production and imports 31.0 percent of the value of total sales of products of the industry (see Table 1). As can be understood from the industry description below, it produces materials for other industries, for commerical use and directly for the consumer. Chemicals are an input of almost every industry and are a cost of production, large or small, in each case. Their only direct representation in the consumer price index is as pharmaceuticals which account for 1.0 percent of the total index.

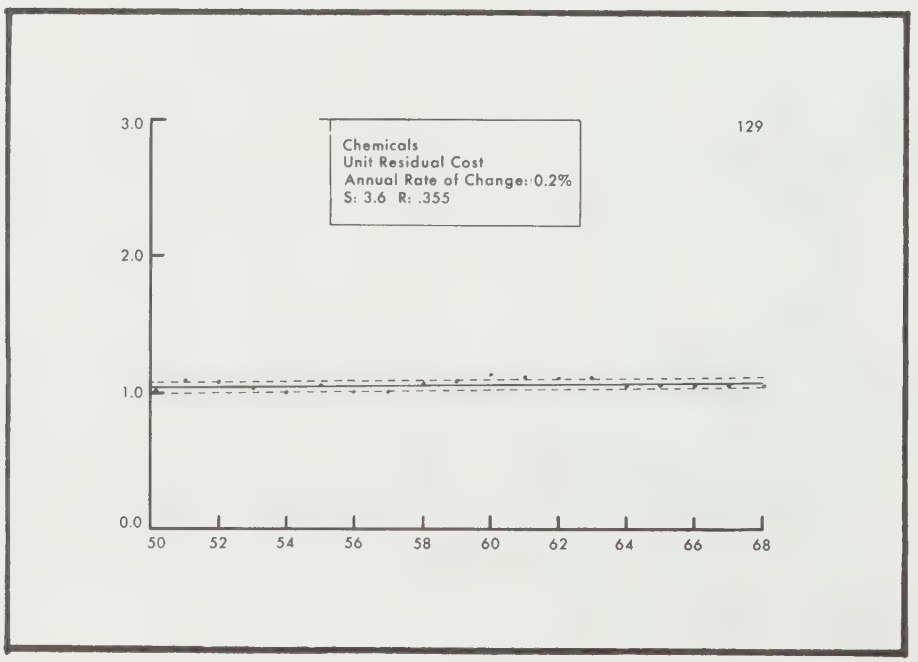
Summary Table — Principal Statistics

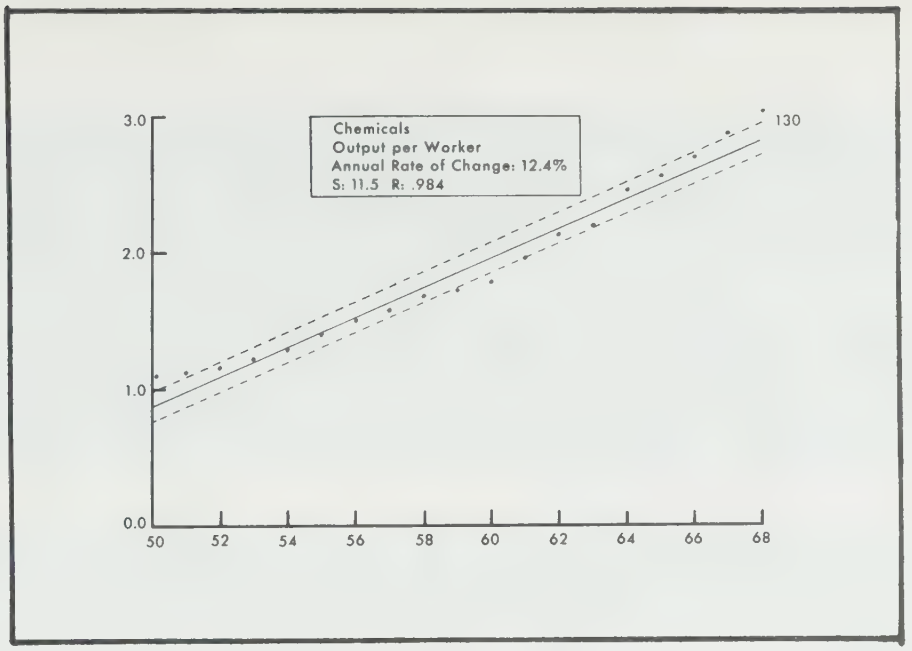
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			447.9			175.2			
Index of value added (1949 or 1961 = 100)			459.3			166.3		167.1	
Index of employment (1949 or 1961 = 100)	148.7	147.2		121.5	113.1				
Index of compensation per worker (1949 or 1961 = 100)	270.0	254.9		138.2	128.2				
Annual trend rate, compensation per worker	+7.6%	+7.6%		+5.6%	+4.3%				
Implicit, value-added price — index, 1949 or 1961 x 100			102.5			94.9		95.3	
— Annual trend rate of change			−0.1%			−0.7%		−0.7%	
— R value			.199			.647		.718	
Output per worker — index, 1949 or 1961 = 100	301.3	304.1		144.3	154.8				
— Annual trend rate of change	+12.9%	+12.4%		+5.4%	+7.4%				
— R value	.991	.984		.981	.994				
Unit labour cost — index, 1949 or 1961 = 100	89.6	83.8		95.8	82.8				
— Annual trend rate of change	−1.4%	−1.1%		0.0%	−2.2%				
— R value	.859	.815		.024	.932				
Unit residual cost — index, 1949 or 1961 = 100	105.9	112.6		94.8	100.8		101.3		
— Annual trend rate of change	+0.2%	+0.5%		−0.9%	0.0%		−0.1%		
— R value	.355	.596		.810	.012		.101		
Payroll as a proportion of value added 1949	20.4%	34.9%							
1961				17.7%	32.7%		32.0%		
1968	17.8%	38.0%					27.8%		
Trend rate of change in labour share	−1.2%	−1.0%		+0.8%	−1.5%		−1.4%		
— R value	.859	.766		.649	.903		.929		
Trend rate of change in residual share	+0.3%	+0.6%		−0.2%	+0.8%		+0.7%		

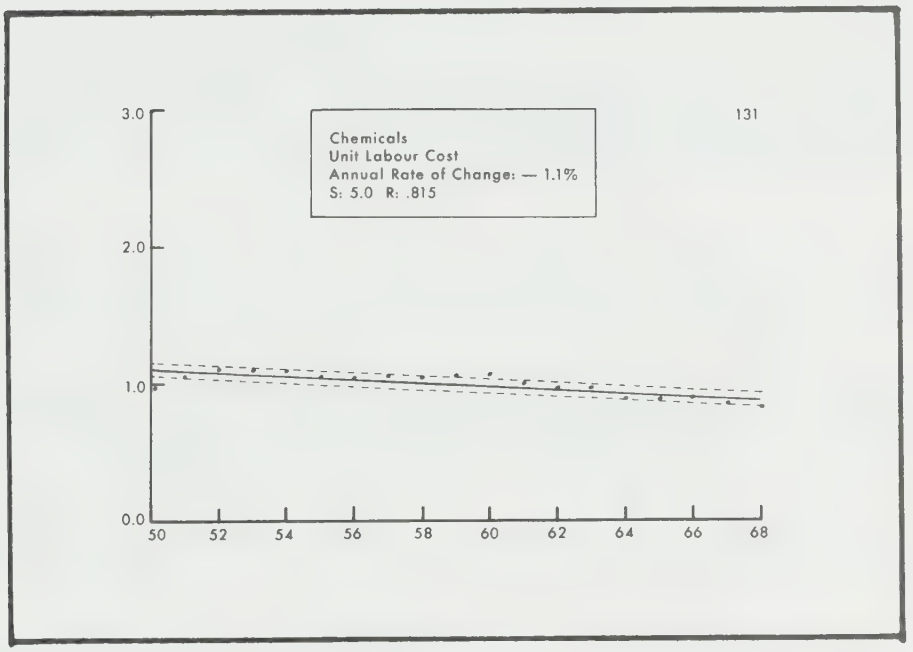
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

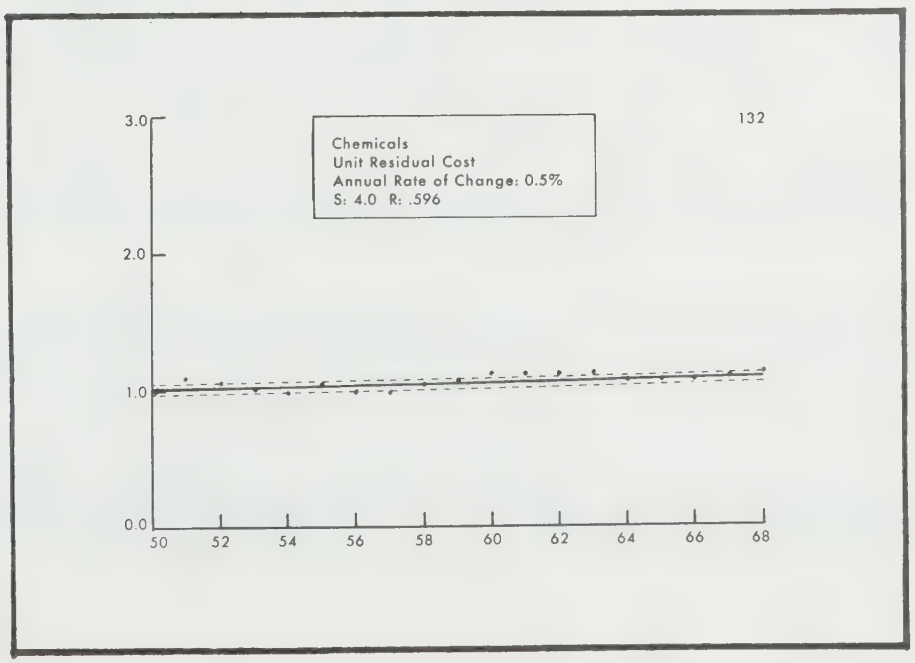

Chemicals
Output per Worker
Annual Rate of Change: 12.9%
S: 8.9 R: .991
127
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Chemicals
Unit Labour Cost
Annual Rate of Change: — 1.4%
S: 5.1 R: .859
128
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Chemicals
Unit Residual Cost
Annual Rate of Change: 0.2%
S: 3.6 R: .355
129
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


Chemicals
Output per Worker
Annual Rate of Change: 12.4%
S: 11.5 R: .984
130
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Chemicals
Unit Labour Cost
Annual Rate of Change: — 1.1%
S: 5.0 R: .815
131
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


Chemicals
Unit Residual Cost
Annual Rate of Change: 0.5%
S: 4.0 R: .596
132
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68

The chemical and chemical products industries (called herein the chemicals industry for ease of presentation) comprise: explosives and ammunition manufacturers (Standard Industrial Classification code 371); mixed fertilizers (S.I.C. code 372) covering superphosphates and mixed fertilizers; plastics and synthetic resins (S.I.C. code 373); pharmaceuticals and medicines (S.I.C. code 374), including patent and proprietary medicines, veterinary medicines, vitamin products, serums, vaccines, antibiotics, etc.; paint and varnish (S.I.C. code 375) including not only paints, varnishes, lacquers, enamels and shellac, but also putty, filler, oil stain, and thinner; soap and cleaning compounds (S.I.C. code 376) including soap, synthetic detergents, washing powders, scouring powders and hand cleansers as well as household laundry bleaches and bluing; toilet preparations (S.I.C. code 377), including perfumes, cosmetics, lotions, hair dressings, toothpaste, etc.; industrial chemicals (S.I.C. code 378), including basic industrial inorganic chemicals such as acids, alkalis, salts, compressed gases, also dry colours, pigments, white leads, lead oxides, etc., and synthetic rubber; and other chemical industries (S.I.C. code 379) including manufacture of insecticides, germicides, inks, matches, adhesives, polishes and dressings, also deodorants, disinfectants, sweeping compounds, etc. In each case the manufacture of the product must be the principal activity of the establishment if it is to be coded to that industry group.[42]

When the new S.I.C. was introduced in 1960, no serious breaks occurred in the continuity of the data for the industry under the old and new classifications. The adjustments necessary to secure full continuity are described in Appendix A. Should this study be followed by further reports, an industry as varied and complex as this would not be treated as a separate unit. However, in this case as with certain other industries, continuity of data over the 1949-1968 period was only possible by treating the industry as a whole.

Production in the industry increased much more than average over the full period and a little moreso over the short period; the 1949-1968 increase of 347.9 percent was more than twice the average increase of 170.6 percent, and the 1961-1968 increase of 75.2 per cent about one-quarter greater than the 61.1 percent for all manufacturing (see Table 2). Only one of the industries studied showed a greater increase over the full period. Value added by manufacturing increased more than average over the full period - 359.3 percent being almost 40 percent greater than the average of 259.9 percent - and just about average over the short period, 66.3 percent compared with 71.0 percent for all manufacturing. Value added by total activity increased 67.1 percent, significantly less than the average 78.1 percent.

Employment of production labour increased more than average over the full period and in line with the average over the short period, while total labour employment rose more than average over the full period and less than average over the short period. The 1949-1968 increase for production labour was 48.7 percent, almost 80 percent more than the 27.2 percent for all manufacturing, while the 1961-1968 increase of 21.5 percent was just slightly above the 19.7 percent for all manufacturing (see Table 3). Total labour employment went up 47.2 percent for production labour, meaning, in effect, that all the employment increase was in the production labour component of the total. This increase was a little less than 50 percent above the 32.8 percent for all manufacturing. Between 1961 and 1968 the increase was 13.1 percent, 40 percent less than the 21.5 percent for production labour, meaning that nonproduction labour employment had actually declined. The 13.1 percent rise in total employment was less than half the 29.8 percent for all manufacturing.

There was little change in the proportions of production of nonproduction labour, at least not in the initial and terminal years covered by this study. In 1949 production labour constituted 64.9 percent of the total and it was 64.7 percent in 1967 (1968 data not being available when this information was compiled; see Table 5).

Compensation (annual wages, annual wages and salaries) per worker increased slightly more than average over the full period but significantly less than average over the short period. Annual wages per production worker in 1968 were 170.0 percent above their 1949 level, an increase only slighlty greater than that of 161.5 percent for all manufacturing. The annual trend rate of increase over the full period was 7.6 percent, a little above the 7.2 percent average. Between 1961 and 1968 production worker compensation moved up 38.2 percent, a little less than the 43.9 percent for all manufacturing, and the trend rate of increase of 5.6 percent was also slightly below the average rate of 6.3 percent.

Annual wages per production worker did not increase quite as much as average hourly earnings between 1949 and 1968, and the increase in wage rates fell in between. However, the differences were too small to be of any significance. The increases in annual wages per worker, average hourly earnings, and wage rates were respectively, 170.0, 179.7, and 175.7 percent, and between 1961 and 1968 they were 38.2, 35.8 and 40.9 percent (see Table 9A).

Annual wages and salaries per worker increased 154.9 percent between 1949 and 1968, a little less than the average increase of 166.5 percent, but the annual trend rate of increase of 7.6 percent was slightly above the average of 7.5 percent, and it was also identical with the rate of increase in production worker compensation. Over the 1961-1968 period the increase in total labour compensation per worker fell behind that for production labour. The percentage increase was 28.2 percent, almost 40 percent less than the 45.9 percent rise for all manufacturing. The 4.3 percent trend rate of increase was almost one-quarter less than the 5.6 percent for production labour and was one-third below the 6.3 percent for all manufacturing.

Implicit (value-added) price showed no net change over the full time period studied. The index in 1968 was 2.5 percent higher than in 1949, but it reached its high, namely, 10.2 percent above the base year, in 1960, and there was no statistically significant trend rate of change. Between 1961 and 1968 there was a downtrend since the high point, as just mentioned, was

attained in 1960 and the trend was downward after that. Relative to value added, manufacturing, implicit price was 5.1 percent lower in 1968 than 1961 and relative to value added, total activity, 4.7 percent lower. In both cases the annual trend rate of decrease was -0.7 percent, to be compared with a rate of increase of 0.9 percent relative to value added, manufacturing in all manufacturing and 1.7 percent relative to value added, total activity. With respect to both measures of implicit price change over the short period, four of the other industries studied also had rates of decrease and in both cases three of them showed greater declines than in the industry (see Table 16).

The industry selling price index for the chemical and chemical products industries registered a 1.0 percent increase between 1961 and 1968, compared with a reduction of implicit (value-added) price of more than 4.5 percent. Since industry selling prices are similar to wholesale prices but measured on an industry rather than commodity basis, and therefore reflect the cost of raw material, fuel and energy inputs that are not part of value added, it appears that raw material costs or certain costs at the wholesale level must be responsible for the slight rise in the industry selling price in the face of declining value-added price.

Output per worker increased significantly more than average for both categories of labour over both time periods. Between 1949 and 1968 output per production worker increased 201.3 percent, more than 75 percent in excess of the 112.7 percent increase for all manufacturing (see Table 17). The annual trend rate of increase was 12.9 percent, more than twice the rate for all manufacturing, and exceeded by the rates for only two of the industries studied (see Table 19). Between 1961 and 1968 the increase was 44.3 percent, a little more than one-quarter more than the 34.6 percent for all manufacturing. The trend rate of 5.4 percent was, as for most industries, less than for the full period, but still almost twice the average rate of 3.7 percent; however, five industries had larger rates.

For total labour the increase between 1949 and 1968 was 204.1 percent, almost twice the increase of 103.7 percent in all manufacturing. The annual trend rate of increase was 12.4 percent, slightly below the 12.9 percent for production labour, more than twice the average rate of 5.8 percent; only two industries had higher rates (see Table 19). Between 1961 and 1968 the increase was 54.8 percent, 2 1/4 times the increase of 24.1 percent for all manufacturing. The trend rate of 7.4 percent was almost 40 percent greater than the 5.4 percent for production labour and 90 percent greater than the average of 3.9 percent; only one industry had a larger rate of increase.

Unit labour cost followed a definite downtrend over the full period for both categories of labour. It moved downward even more rapidly with respect to total labour over the short period, while for production labour it levelled off to a position of no net change.

Between 1949 and 1968, there was a drop, with respect to production labour only, of 10.4 percent, to be compared with an average increase of 23.0 percent. There was an annual trend rate of decrease of -1.4 percent, to be compared with an average rate of increase of 0.5 percent. Ten other industries showed a downtrend and four of them had greater rates of decrease than this industry's (see Table 26). It can be seen from the chart and the annual indexes (Table 24) that the index moved to a maximum in 1952 and 1953, which was followed by a rather steady drop until the 1960's when it fluctuated within a narrow range showing relatively no trend up or down. In all manufacturing over this short period there was a trend rate of increase of 2.0 percent per annum.

Between 1949 and 1968 unit labour cost with respect to total labour declined 16.2 percent while there was an increase of 30.8 percent in all manufacturing. The annual trend rate of decline of -1.1 percent was a little less than the -1.4 percent for production labour only and is in contrast with an average trend rate of increase of 0.7 percent per annum. Nine other industries had rates of decrease, two of which were greater than that for this industry. Between 1961 and 1968 there was a drop of 17.2 percent, while in all manufacturing there was an increase of 17.6 percent. The annual trend rate of decrease of -2.2 percent was twice what it was for the full period, is to be compared with a no-change trend over the short period for production labour, and a rate of increase of 1.9 percent in all manufacturing. Of the five industries showing declining unit labour costs for total labour over the short period, the decline was greatest for this industry.

The contrast with production labour can be seen from the fact that the index did not rise quite as high for total labour in 1952 and 1953 and followed a steadier decline thereafter which continued right through to 1968. However, it should be observed that the index for total labour was higher than that for production labour right through from 1955 to 1966 (see Table 24).

Unit residual cost tended to show little net change over the full period. With reference to production labour, it seemed to follow a nonlinear path (see Appendix C). There was a slight uptrend in the 1950's for both measures, a more definite downtrend in the 1960's relative to production labour, and no net change with respect to total labour.

Between 1949 and 1968 unit residual cost, relative to production labour, increased only 5.9 percent, compared with an average increase of 38.9 percent (see Table 28). An increase as high as 12.9 percent took place bwteeen 1949 and 1960, but even this was less than half of the 29.6 percent for all manufacturing over the same period. There is some evidence of a slight cyclical pattern over the full period, which is why the fit for one curvilinear regression that was computed showed an R value of .649, compared with .355 for the linear regression (see Appendix C) which is not significant at the 95 percent level. The

annual trend rate of increase of 0.2 percent suggests that there was a slight uptrend, while the rate of decline of -0.9 percent for the short period (significant at the 99 percent level) indicates that the uptrend occurred in the 1950's followed by a moderate downward movement in the 1960's, which is borne out by an inspection of the annual indexes in Table 28. The slight upward trend in the 1950's is much less than the stronger movement in most of the industries studied; over the full period there was a trend rate of increase for all manufacturing of 1.3 percent, and 15 of the industries studied showed larger annual rates of increase (see Table 31). Over the short period seven industries, including this one, showed rates of decrease, five of which were greater than this one; for all manufacturing there was no significant net change.

With respect to total labour, unit residual cost was 12.6 percent greater in 1968 than in 1949, barely more than one-third of the 35.1 percent increase for all manufacturing. The annual trend rate of increase of 0.5 percent not only exceeded the 0.2 percent for the measure relative to production labour, but was significant at the 99 percent level (the other measure was not significant even at the 95 percent level); however, it was 60 percent less than the 1.2 percent for all manufacturing and 12 of the industries studied had larger rates. Over the short period there was a zero rate of change not only for the measure relative to total labour and value added by manufacturing but also for the measure related to total labour and value added by total activity. This lack of change is indicated by the fact that the index for the measure relative to value added by manufacturing averaged 109.9 for the years 1961 to 1968 inclusive and the highest and lowest values during that time showed about the same difference from the average; the 1968 index was 2.7 points above the average and the 1964 index 3.0 points below. This condition of stability in unit residual cost over the short period was found in only three other industries (see Table 31). The situation of no net change in all manufacturing resulted from the high rates of increase in some industries being offset by equally high rates of decrease in others.

The production labour share of value added declined over the full period but showed a small recovery in the short period. The decline in the total labour share, which was steady over the full period, was even more pronounced over the short period.

The production labour share in 1949 was 20.4 percent, almost half the 36.8 percent in all manufacturing. Only two industries had smaller values in that year. It dropped to 17.7 percent in 1961 and was 17.8 percent in 1968. The annual trend rate of decrease of -1.2 percent was three times the average rate of -0.4 percent; 14 industries showed rates of decrease, six of them greater than for chemicals and one the same (see Table 36). As can be seen, there was a slight recovery between 1961 and 1968, indicated by a trend rate of increase of 0.8 percent, which, however, was less than the rate of increase of 1.1 percent for all manufacturing and the rates for seven of the other industries; however, 11 other industries showed declining production labour shares over this period.

The total labour share in 1949 was 34.9 percent, a little more than one-quarter less than the share in all manufacturing; five of the other industries showed smaller shares in that year. By 1961 it was down to 32.7 percent and by 1968, to 28.5 percent. There was an annual trend rate of decrease of -1.0 percent for the full period and -1.5 percent for the short period. The full-period rate of -1.0 percent was a little less than the -1.2 percent for production labour but much more than the -0.2 percent for all manufacturing; 13 other industries showed rates of decrease, three of them greater than this industry's, and one other the same (see Table 31). The short-period rate of -1.5 percent is in contrast with a rate of increase of 1.1 percent for all manufacturing; of the 11 other rates of decrease, two were slightly larger. Over the short period there was a similar reduction in the total labour share of value added by total activity.

The composition of implicit (value-added) price change for the chemicals industry is as follows:

	Trend rate unit labour cost		Base labour weight		Trend rate unit residual cost		Base residual weight		Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(-1.4	x	.204)	+	(0.2	x	.796)	=	0.1	-0.1
Tot. lab., 1949-68[x]	(-1.1	x	.349)	+	(0.5	x	.651)	=	0.1	-0.1
Prod. lab., 1961-68[x]	(0.4	x	.177)	+	(-0.9	x	.823)	=	0.7	-0.7
Tot. lab., 1961-68[x]	(-2.2	x	.327)	+	(0	x	.673)	=	0.7	-0.7
Tot. lab., 1961-68[y]	(-2.2	x	.320)	+	(-0.1	x	.680)	=	-0.8	-0.7

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

For reasons explained in this part of the preceding section, on petroleum and coal products, differences can be expected between the values in columns A and B. In this industry there are no important differences.

Over the full period, covered by the first two equations, the stronger downtrend in unit labour cost more than offset the moderate uptrend in unit residual cost, in spite of the larger residual weights. The stability of unit production labour cost over the short period meant that the decline in implicit price entirely reflected declining unit residual cost (equation three); exactly the opposite situation occurred with respect to total labour (equation four); in the last equation, practically all of the decline in implicit price consisted of a unit labour cost component.

All manufacturing

Our analysis of all manufacturing is less extensive and detailed than that for each separate industry because all manufacturing data have been considered in Chapters Six to Nine inclusive and have been used as a basis of comparison in the separate industry sections of this chapter.

Trend rates of change for production were not computed, but simple annual averages of the change over the full and short periods suggest that there was no significant acceleration or deceleration in production. The 170.6 percent increase over 1949-1968 averages out (uncompounded) at 9.0 percent per annum, and the 61.1 percent over 1961-1968 averages out at 8.7 percent. However, there was some slowing down in the increase of value added by manufacturing; the 259.9 percent increase over 1949-1968 averages 13.7 percent annually, and the 71.0 percent over 1961-1968 averages 10.1 percent. This is borne out by the fact that the full-period annual trend rate of increase in value added per unit of output (implicit value-added price) was 1.0 percent and over the short period (1961-1968) was 0.9 percent. While in some industries the change in value added by total activity over 1961-1968 was notably greater or less than value added by manufacturing activity, this was not so for all manufacturing; by manufacturing activity, the increase was 71.0 percent, by total activity, only slightly more, at 78.1 percent.

Employment increased much more in the recent period than over the full period. The employment of production labour increased 27.2 percent between 1949 and 1968 or at a simple average annual increase of 1.4 percent, while between 1961 and 1968 the increase was 19.7 percent, which works out to 2.8 percent per annum. Total labour employment went up 32.8 percent over the full period, or 1.7 percent per annum, and 29.8 percent over the short period, or 4.3 percent per annum. In the case of production labour, the increases peaked between 1963 and 1966, which was about the same for total labour also, except for an increase of almost ten percent between 1961 and 1962.

The proportion of production workers to total employment dropped from 81.1 percent in 1949 to 77.7 percent in 1968. This was a reduction of 3.4 percentage points and 4.2 percent. However, over the time period there was no statistically significant trend upward or downward (see Table 5). Nevertheless, it is clear that the nonproduction proportion increased in view of the greater increases in total employment (including nonproduction labour) than in production employment alone. (This is considered in detail in the section on employment in Chapter Six.)

Compensation (average wages and salaries) per worker showed a slightly greater increase over the full period than compensation (average wages) per production worker. The increase for production workers was 161.5 percent and the annual trend rate of increase was 7.2 percent, while for total labour (that is, average wages and salaries for production and nonproduction labour combined) the increase between 1949 and 1968 was 166.5 percent, only 3.1 percent greater than the increase for production labour, and the annual trend rate, at 7.5 percent, was 4.2 percent greater than the 7.2 percent for production labour. Even this slight edge over production labour disappears over the 1961-1968 period. The trend rate of 6.3 percent applies to both categories of labour. (For more detailed analysis, see the section on wages and salaries in Chapter Six.)

Implicit (value-added) price increased 33.0 percent between 1949 and 1968 and 6.2 percent over the more recent 1961-1968 period, and the annual trend rate of increase was almost the same, 1.0 percent over the full period and 0.9 percent over the short period. However, among the industries studied the rate of price change in the short period was less for twelve of them and greater for nine than over the full period (see the section on prices in Chapter Six). The increase in implicit price relative to value added by total activity was greater than in that relative to value added by manufacturing; the annual trend rate for the 1961-1968 period was 1.7 percent relative to total activity and 0.9 percent relative to manufacturing activity only. The reason for this difference calls for analysis of the data in greater depth than was intended for this study. We merely point out that the difference did exist.

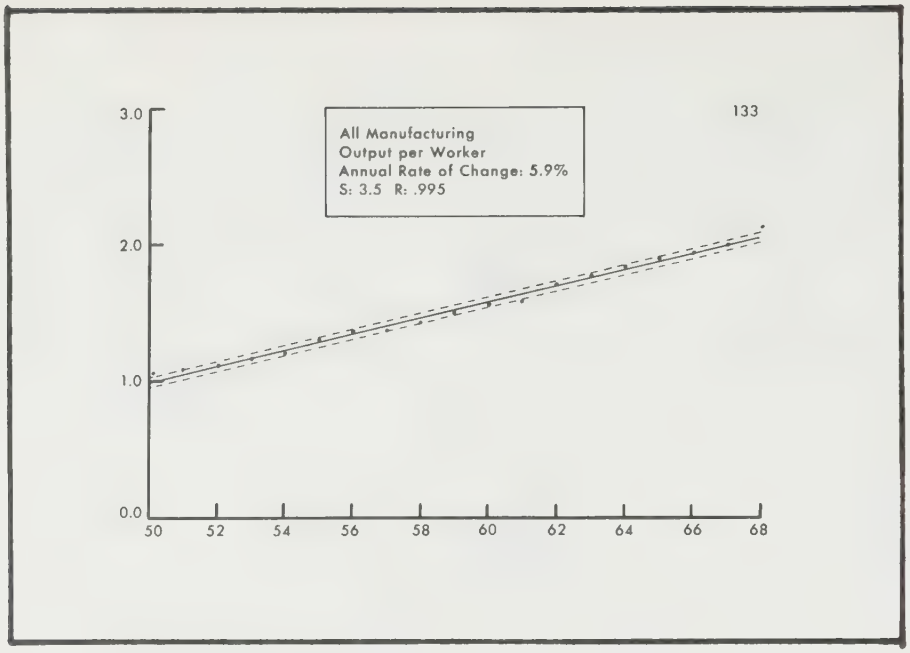
Labour productivity (output per worker) did not increase as much over the more recent period as it did, on the average, over the full period. The annual trend rates of increase over the full period were 5.9 percent for production labour and 5.8 percent for total labour, over the short period they were both less, but the drop was greater for production labour, the rates being 3.7 and 3.9 percent. (For a detailed analysis of labour productivity trends, see Chapter Seven.)

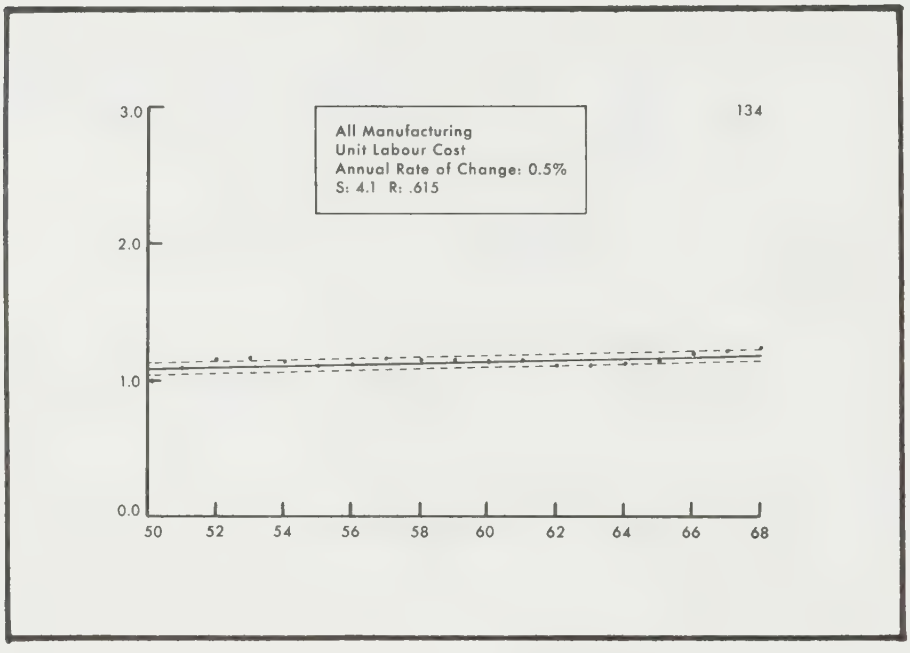
ALL MANUFACTURING

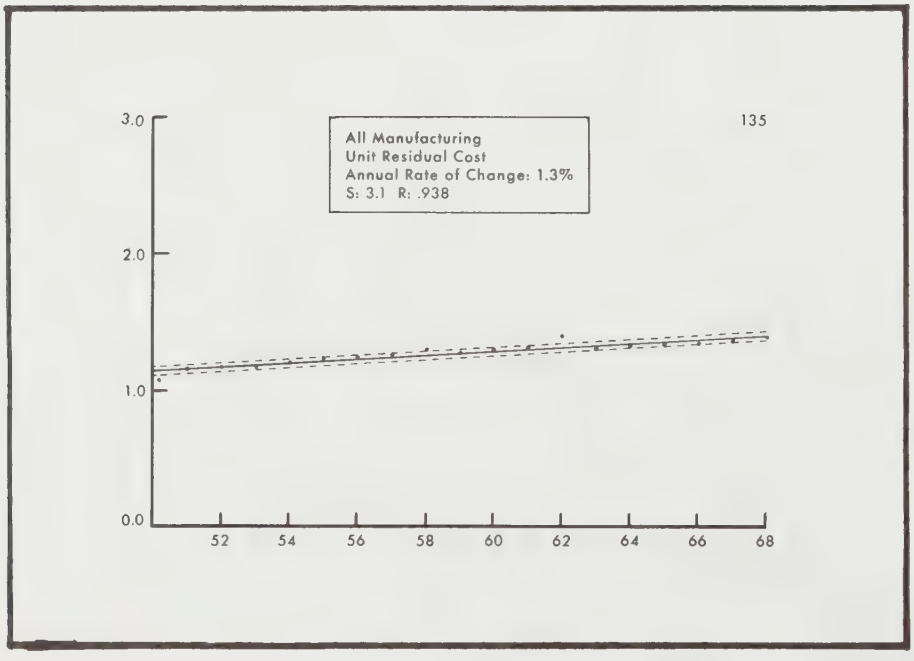
Summary Table — Principal Statistics

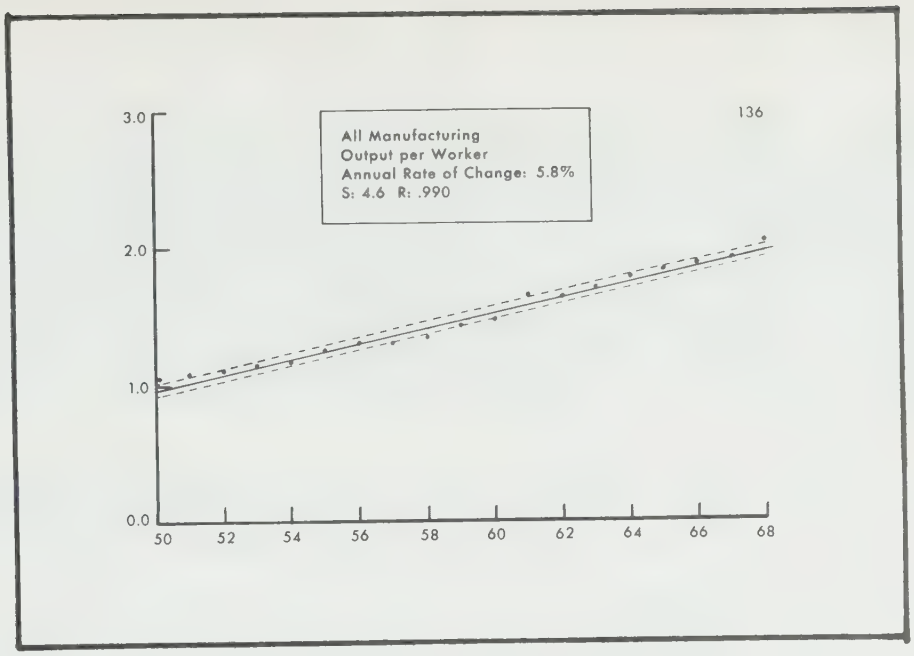
	1949 to 1968			1961 to 1968					
	Value Added by			Manufacturing Activity			by Total Activity		
	Production labour	Total labour	Other	Production labour	Total labour	Other	Total labour	Other	Other
Index of production (1949 or 1961 = 100)			270.6			161.1			
Index of value added (1949 or 1961 = 100)			359.9			171.0		178.1	
Index of employment (1949 or 1961 = 100)	127.2	132.8		119.7	129.8				
Index of compensation per worker (1949 or 1961 = 100)	261.5	266.5		143.9	145.9				
Annual trend rate, compensation per worker	+7.2%	+7.5%		+6.3%	+6.3%				
Implicit, value-added price — index, 1949 or 1961 = 100			133.0			106.2		110.5	
— Annual trend rate of change			+1.0%			+0.9%		+1.7%	
— R value			.913			.705		.984	
Output per worker — index, 1949 or 1961 = 100	212.7	203.7		134.6	124.1				
— Annual trend rate of change	+5.9%	+5.8%		+3.7%	+3.9%				
— R value	.995	.990		.987	.989				
Unit labour cost — index, 1949 or 1961 = 100	123.0	130.8		106.9	117.6				
— Annual trend rate of change	+0.5%	+0.7%		+2.0%	+1.9%				
— R value	.615	.668		.958	.910				
Unit residual cost — index, 1949 or 1961 = 100	138.9	135.1		105.8	98.8		105.0		
— Annual trend rate of change	+1.3%	+1.2%		+0.2%	−0.1%		+1.6%		
— R value	.938	.888		.206	.176		.984		
Payroll as a proportion of value added 1949	36.8%	48.6%							
1961				33.8%	43.2%		44.3%		
1968	34.0%	47.8%					46.1%		
Trend rate of change in labour share	−0.4%	−0.2%		+1.1%	+1.0%		+0.2%		
— R value	.703	.335		.916	.884		.286		
Trend rate of change in residual share	+0.2%	+0.2%		−0.6%	−1.0%		−0.1%		

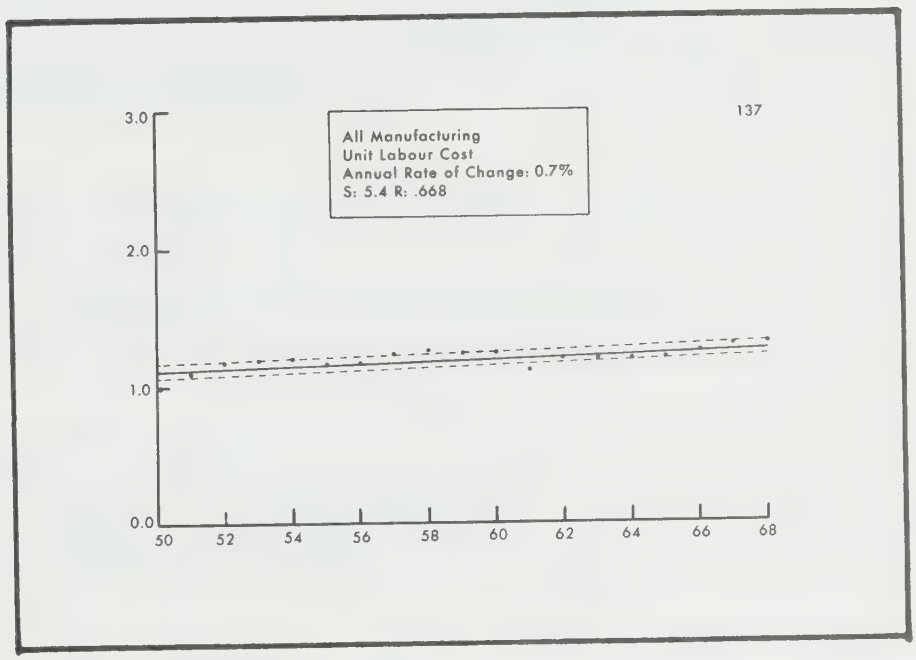
Note: All indexes are expressions of 1968 values in relation to a 1949 or 1961 base.

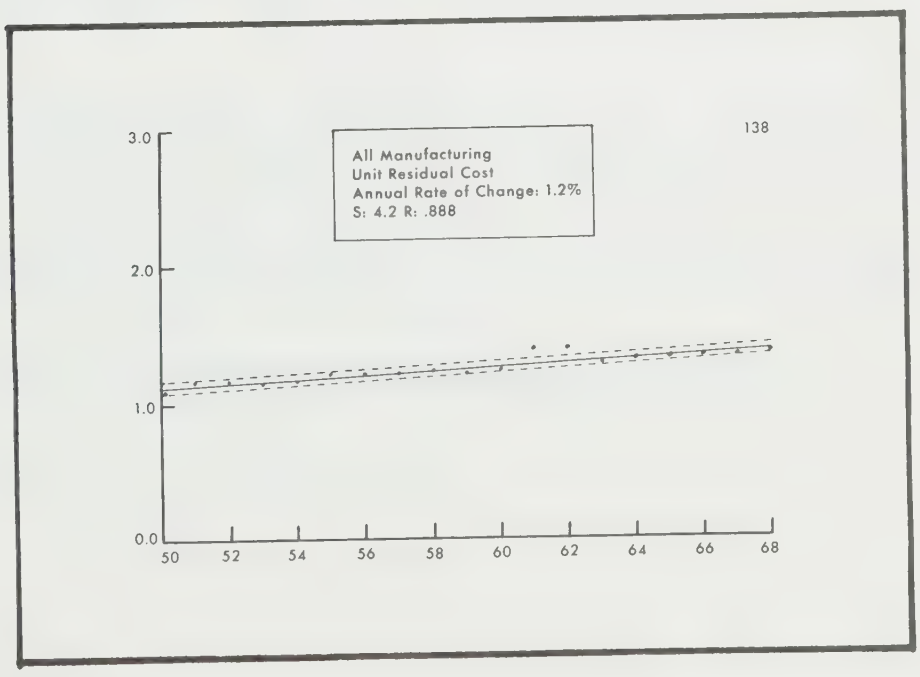

133
All Manufacturing
Output per Worker
Annual Rate of Change: 5.9%
S: 3.5 R: .995
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


134
All Manufacturing
Unit Labour Cost
Annual Rate of Change: 0.5%
S: 4.1 R: .615
3.0
2.0
1.0
0.0
50 52 54 56 58 60 62 64 66 68


135
All Manufacturing
Unit Residual Cost
Annual Rate of Change: 1.3%
S: 3.1 R: .938
3.0
2.0
1.0
0.0
52 54 56 58 60 62 64 66 68


136
All Manufacturing
Output per Worker
Annual Rate of Change: 5.8%
S: 4.6 R: .990
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


137
All Manufacturing
Unit Labour Cost
Annual Rate of Change: 0.7%
S: 5.4 R: .668
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68


138
All Manufacturing
Unit Residual Cost
Annual Rate of Change: 1.2%
S: 4.2 R: .888
3.0
2.0
1.0
0.0
50
52
54
56
58
60
62
64
66
68

The rate of increase in compensation per worker did not moderate as much during the recent period as the rate of increase in output per worker; therefore, the rate of increase in unit labour cost accelerated. The slowing down was greater for wages and salaries per worker than for wages only per production worker, but the growth rate in output per worker showed less reduction over the 1961-1968 period for total labour than for production labour. (The annual trend rate of increase in compensation per worker was 12.5 percent less for production labour and 16.0 percent less for total labour over the recent period than over the full period; the growth rate in output per worker was 37.3 percent less for production labour and 32.8 percent less for total labour.) Thus, the trend rate of annual increase in unit labour cost moved up from 0.5 percent over the full period to 2.0 percent over the recent period for production labour, and for total labour it rose from 0.7 percent to 1.9 percent. The acceleration was greater for production labour,as the foregoing analysis indicates. (Unit labour cost is considered in some detail in Chapter Eight.)

The trend in unit residual cost was the opposite of that for unit labour cost. Over the full period the annual trend rate of increase was greater for unit residual cost than for unit labour cost, and over the more recent, short period, while there was a marked acceleration in unit labour cost, there was such a decline in the trend in unit residual cost that it moved into a situation of no net change, or virtual stability, between 1961 and 1968.

The annual trend rates of increase over the full period were 1.3 and 1.2 percent with respect to production labour and total labour respectively, notably in excess of the 0.5 and 0.7 percent rates for unit labour cost. Over the 1961-1968 period the computed trend rates were 0.2 percent and -0.1 percent but with R values of only .206 and .176, neither was statistically significant. However, an examination of the charts and the index numbers in Table 28 shows that, after a sharp jump between 1961 and 1962 and an equally sharp drop between 1962 and 1963 in unit residual cost relative to production labour, there was a steady rise thereafter right through to 1968; for the measure relative to total labour, the index in 1962 remained about the same as in 1961 but did drop sharply in 1963 and increased steadily thereafter, except for a slight break in 1967. It is the sudden changes between 1961 and 1963 that explain the lack of a statistically significant trend in spite of the upward movement from 1963 to 1968.

The analysis in the previous paragraph was confined to unit residual cost relative to value added by manufacturing. Since 1961 with the introduction of the total activity concept, we have also computed unit residual cost relative to value added by total activity. Unlike the other two measures, this one showed a substantial upward trend over 1961-1968 that was of high statistical significance. It showed an annual trend rate of increase of 1.6 percent ($R = .984$), but still somewhat less than the trend rates of 2.0 and 1.9 percent for unit labour cost over the same period. In spite of the large annual rate of increase, the 1968 index was only 5.0 percent in excess of that for 1949; this is because of a 4.4 percent drop between 1961 and 1962 and a steady year-to-year rise thereafter (see Table 28).

We must repeat that this study does not try to explain differences between measures related to value added by manufacturing and value added by total activity. At this juncture, suffice it to state the fact without explanation. In the matter of unit residual cost it is especially important to note the difference because if attention is limited to the measures related to manufacturing activity only, it would appear that all the increase in unit costs of production during 1961-1968 was to be attributed to labour. Of course, even this is not so if our analysis focuses on 1963-1968 rather than 1961-1968; but it is even less true when unit residual cost is measured in relation to total activity. (For further details, see the section on unit residual cost in Chapter Nine.)

Factor shares, (i.e. the share of income from value added going to labour and to the residual inputs) showed little change over the full period; over the short period there was a notable increase in the share going to production labour when the point of reference is value added by manufacturing activity; but there was no statistically significant change when value added by total activity is taken into account.

The production labour share was 36.8 percent in 1949 and 34.0 percent in 1968, 2.8 percentage points and 7.6 percent less. There was an average trend rate of decrease of -0.4 percent per annum. In 1961 the share was 33.8 percent, almost the same as in 1968, but there was an annual trend rate of increase of 1.1 percent (of high statistical significance, with $R = .916$) because of a drop from 33.8 percent in 1961 to 31.7 percent in 1962 followed by a steady rise thereafter to 34.0 percent in 1968 (see Table 34). Similar observations apply to the total labour share except that there was no drop between 1961 and 1962. When value added by total activity is the reference point, the total labour share was 44.3 percent in 1961 and 46.1 percent in 1968; there was no indication of an upward or downward trend. (For further details, see the section on changes in factor shares in Chapter Nine.)

The unit cost components of implicit (value-added) price for all manufacturing are as follows:

	Trend rate unit labour cost		Base labour weight	Trend rate unit residual cost		Base residual weight	Implicit (value-added) price change A	B
Prod. lab., 1949-68[x]	(0.5	x	.368)	+ (1.3	x	.632)	= 1.0	1.0
Total lab., 1949-68[x]	(0.7	x	.486)	+ (1.2	x	.514)	= 1.0	1.0
Prod. lab., 1961-68[x]	(2.0	x	.338)	+ (0.2	x	.662)	= 0.8	0.9
Total lab., 1961-68[x]	(1.9	x	.432)	+ (-0.1	x	.568)	= 0.8	0.9
Total lab., 1961-68[y]	(1.9	x	.443)	+ (1.6	x	.557)	= 1.7	1.7

x - related to value added manufacturing
y - related to value added total activity
A - as calculated from this equation
B - as calculated by computer (see Table 16)

In the first equation the unit labour cost component is 18.4 percent of the implicit price change, in the second equation, 34.0 percent. Over the more recent period unit labour cost was a larger component; in the third equation it is 84.5 percent and in the fourth equation, 102.6 percent. This last percentage is greater than 100 because, while implicit price was increasing, unit residual cost was decreasing at an annual rate of -0.1 percent; unit labour cost, proportionate to its weight, was increasing 2.6 percent more per annum than implicit price.[43] However, in the last equation where value added by total activity is the point of reference and unit residual cost showed a marked rate of increase rather than a rate of decrease, unit labour cost was 49.5 percent of implicit price change.[44]

Footnotes

[1]For the sake of brevity, 1949-1968 is sometimes called the full period and 1961-1968, the short period.

[2]Also for the sake of brevity, the term, "average" is used sometimes to refer to the situation for all manufacturing.

[3]A fuller comparison of trends in annual wages per worker with average hourly earnings and occupational wage rates can be made from Table 9A.

[4]Such a comparison is introduced at this point in each industry analysis, the extent of the comparison in each case depending on the availability of wholesale and retail price data. All such data, unless stated otherwise, are obtained from the monthly Statistics Canada report, *Prices and Price Indexes* (Catalogue No. 62-002).

[5]Based on the industry selling price index which measures change in wholesale or factory shipment prices (f.o.b. from the plant less sales and excise taxes) of the commodities produced by each industry and that are selected to represent total output of the industry, each commodity price index weighted, in making up the industry index, according to its importance in total output.

[6]This is the term used in the monthly report on prices and covers the same industry as the term "slaughtering and meat processors", used in other Statistics Canada reports mentioned here.

[7]This discussion has not taken into account the rate attributed to total labour and value added, total activity, which has been included in the tables for readers who want such information.

[8]For the sake of brevity, throughout this chapter, payroll as a proportion of value added is called the labour share; the residual share is, obviously, what is left over. The shares are in relation to value added by manufacturing activity; value added by total activity is not taken into account unless it is explicitly pointed out.

[9]This is the manual issued in December 1960 and is the basis for the classifications used in this study. A revised manual of the same catalogue number was issued in December 1970 but is not used in this study.

[10]Smelting and refining is excluded from full-period analysis of value added because of a substantial break between 1960 and 1961 in the continuity of data on value added in that industry.

[11]D.B.S.: *Productivity Trends in Industry, 1947-61*, Report No. 1, (Catalogue No. 14-502)

[12]As is explained in the next paragraph, what is examined here is a group of industries using a common raw material, but for simplicity of presentation and for the sake of brevity, the word, "industry" is used instead of "industry group".

[13]The comparisons here and in similar analysis elsewhere in this chapter are with the trend rates in column A which are the results of the equations presented since it is the composition of implicit price as expressed by the equation that is under discussion. However, as pointed out in the discussion immediately following the equations for slaughtering and meat processors, the trend values given in column B, taken from Table 16, are the more accurate indicators of implicit price trend because they are computed by least squares from the actual implicit (value-added) price indexes for each year. But the discussion here and similar discussions in each industry section are analysis of the components of price change, as set forth in the equations, and must not be accepted as perfectly accurate. They are less than perfectly so to the extent that the value appearing in column A differs from that in column B.

[14]D.B.S.: *Productivity Trends in Industry, 1947-61* Report No. 1, (Catalogue No. 14-502)

[15]While this group is called clothing industries, for the sake of easier presentation we refer to it as an industry.

[16]D.B.S.: *Productivity Trends in Industry, 1947-61*, Report No. 1, (Catalogue No. 14-502).

[17]The comparison is of doubtful value because the trend rate for all manufacturing has little statistical significance since R = .335 only.

[18]D.B.S.: *Productivity Trends in Industry, Report No. 2 - Iron and Steel Mills*, (Catalogue No. 14-503).

[19]For a brief consideration of the importance of external markets to this industry and of external producers to the domestic market, see *Report of the Royal Commission on Farm Machinery*, March, 1971, pages 67-71.

[20]It will be observed from the trend computations in this study that most of the trend rates with low R values are those where the rate itself is small. This means that deviations from the computed values tend to be relatively greater than when the trend rate is larger. And the higher the relative deviations, the poorer the fit, the greater the standard error and lower the R value.

[21]The R value of .449 exceeds the .388 necessary for significance at the 95 percent level but is less than the .529 for significance at the 99 percent level. This means that 95 percent of the observations will fall within two standard errors, plus or minus, of the trend line.

[22]R^2 is $(.449)^2 = .2016$ which, multiplied by 100 gives us 20.2 percent, which is the index of determination. This is chiefly discussed in Chapter Seven.

[23]Christopher J. Maule: *Productivity in the Farm Machinery Industry* Study No. 3 for the Royal Commission on Farm Machinery, 1969.

[24]Trend rates were calculated by least squares for the 1949-1961 period only for this industry so as to facilitate comparison of the two decades, but were not computed elsewhere.

[25]Value added, total activity, was more important to this industry than to most of the others studied, between 1961 and 1968 the proportion of value added, manufacturing to value added, total activity ranging from 73.7 to 91.4 percent. Nevertheless, it would call for a careful analysis of the activities of the industry that is beyond the scope of this study to explain the difference between measures related to value added by manufacturing and value added by total activity. The information is included here in order to complete the record and as the basis for further research, whether it is done by the authors or the readers of this study.

[26]This is difficult to understand. Production declined by 6.0 percent between 1960 and 1961 (see Table 2), while production worker employment increased 32.9 percent (see Table 3). While one cannot expect reductions in output to be matched by equal reductions in employment and one may expect changes in the former and stability in the latter, such reverse shifts as these seem unlikely. It is possible that the changes in classification code and measures of output introduced in 1961 have not been allowed for completely in the adjustments made to permit a linkage of the old and new series. In any event, the series from 1961 on is not subject to any such breaks and it is best to attach more significance to the data for the recent, short period than for the full period.

[27]For one thing, the sharp drop between 1960 and 1961 does not affect this later period, as pointed out just above; but that is not the only reason for the improvement.

[28]It was a reduction of 29.8 percent, from 144.6 percent in 1960 to 101.5 percent in 1961; the reduction with respect to production labour was almost identical, at 29.2 percent.

[29]There can be no doubt about its statistical significance; R = .906; but the break in 1960-1961 does not affect the essential linearity of the curve or the goodness of fit of the actual to the trend values. Because of this and because unit residual cost is similarly affected by the break but still follows a good fit, analysis of the cost components of implicit (value-added) price over the full period is defensible.

[30]Analysis of value added for the earlier period is not possible for this industry for reasons already offered.

[31]While the linear trend rate of 1.0 percent per annum is significant at the five percent level with R = .461, it was found that a nonlinear function is more descriptive of the trend because it brought its significance up to the one percent level with R = .940. The trend is depicted in the chart accompanying this section and the equation and other details are to be found in Appendix C.

[32]Comparison with all manufacturing for the rates related to value added, manufacturing is not possible because the rates in question have no statistical significance. In effect, there was no net change in total manufacturing.

[33]The 1970 revision has made some changes but this study is based on the unrevised S.I.C.

[34]It is certainly not meant to imply that the industries with higher increases in value added "did better". If rising output and a stable price level are criteria of "good performance", this industry behaved very well, in view of its high increase in real output. Value added did not rise as much, in fact, because of the price stability in the industry.

[35]Data on average hourly earnings and occupational wage rates were not available for cement manufacturers which could be compared with annual wages in Table 9A, as is done for the other industries.

[36]No attempt was made to fit a nonlinear function to series over the short period, as was done in some cases for the full period, as shown in Appendix C.

[37]The R value is only .316, which is less than .388 which indicates significance at the 95 percent level; see Appendix C.

[38]Statistics Canada: *Productivity Trends in Industry, Cement Manufacturers, 1959-1969* (Catalogue No. 14-505), December, 1971.

[39]It was found that a nonlinear function improved the R values for the measures of unit residual cost; see Appendix C. However, the full-period linear trend rates are significant at the 95 percent level and those for the short period are significant at the 99 percent level.

[40]For an explanation, see pages 14 and 15.

[41]Statistics Canada: *Productivity Trends in Industry, Petroleum Refineries, 1959-1969* (Catalogue No. 14-504), December 1971.

[42]The 1970 revision to the S.I.C. eliminates explosives and ammunition manufacturers as a separate industry and transfers them to miscellaneous chemical industries. However, this study is based on the S.I.C. before its 1970 revision and in any event, the particular industry remains a part of the chemical industries group.

[43]The demonstration of this requires carrying the computations to three decimal places.

$$(1.9 \times .432) + (-0.1 \times .568)$$

$$.821 - .057 = .764$$

It can be seen that $\frac{1.9 \times .432}{.764} = \frac{.821}{.764} = 107.461$

Therefore $\left(\frac{1.9}{.764}\right) \times .432 = 2.487 \times .432 = 107.435$

(The difference between the two results is due to rounding and for present purposes the results are taken as equal.) This shows that the percentage difference between unit labour cost and implicit price after adjusting for the labour weight, can be

calculated in two ways. Unit labour cost is 2.487 times implicit price, at .764; when its proportion of value added is accounted for, it becomes 1.074, or 107.4 percent of implicit price. The figure mentioned in the text above, of 102.6 percent, is different from that used in this demonstration because of rounding.

[44]It will be recalled that the trend rates for unit residual cost in the third and fourth equations are not statistically significant. However, they are used here because it is better than assigning a zero rate of change. Where the use of such statistically insignificant rates affects the validity of the equation, the figures in columns A and B will differ. This did happen for a few industries. But even in the "worst" situations it has not seriously affected the general conclusions to be drawn from the equations. This question is considered more fully in Appendix B.

CHAPTER ELEVEN

Summary and Conclusions

The very large quantity of data presented in this study, may seem to present a formidable problem in attempting to draw some general conclusions. Indeed, the first conclusion - really, more of an observation - is that generalizations from such a complex mass of data are dangerous and must be offered with caution. Notwithstanding the hazards inherent in the operation, we offer in this chapter a summary of what appear to be the salient findings issuing from our research. It should probably go without saying - but it is being said anyway - that anyone who reads only this chapter of the study does so at his peril, because the reader who has followed the text this far will have been impressed by the enormous variation in industry experience. Statements that apply generally always have exceptions when applied to the kind of subject-matter with which we have been concerned.

Following the summary and statement of conclusions, a few observations are offered on this kind of research and what might be attempted subsequently. This chapter does not summarize or condense in any way our conceptual framework and methodology, nor does it say anything about the source material constituting the data base for our findings. Such information must be obtained from the first five chapters.

However, this much must be said about methodology. Essentially, this study is concerned with change, it seeks to measure change in labour productivity, unit costs of production, prices and related matters. It is not a static analysis; we compare different industries at a point in time only in terms of change in each industry over a measured time period, but not in terms of absolute differences. This has its advantages. It is much easier, for example, to compare percentage increases in output per worker in a steel and a textile mill than to compare levels, such as tons of steel and yards of textiles per worker. But the reason for our choice is that the study is principally concerned with price change and the relation of unit factor cost change to it.

Change is measured in two ways in this study, by index numbers and by annual trend rates. The change between one year and any other can be expressed precisely by comparing the index numbers for the two years. But the percentage difference between one year and another, say, five years later, does not necessarily tell us what happened during the years between the base and terminal (or reference) years. To know if there is a longrun trend and, if so, what kind, some calculation of an annual trend rate of change is required. From this we can discern the average annual rate of change and by relating this to the standard error (S) and the coefficient of correlation (R), which are shown in our tables of trend rates, the reader can ascertain how much of a trend there really is; that is, whether the actual values fit closely to the computed trend values or diverge considerably. If there is a trend but it follows some kind of line other than a straight one, such as an exponential or cycle, the linear trend will show a "poor fit"; however, in Appendix C as well as in the relevant sections of Chapter Ten, many of these nonlinear trends are pointed out.

This brief, preliminary digression on methodology is introduced because it is essential that our analysis of change be understood.

Some of the Principal Findings

1. Great differences are apparent among the industries with respect to all the measures of activity examined in this study.[1] They were much greater for some than for others, which can be observed from Table 32 which averages the values for the industries studied. Confining our observations here to trend rates and using the coefficient of variation as the indicator of interindustry variation, we can draw this picture from Table 32, listing the measures from the lowest to the highest, judging by the average of the coefficients of variation shown under B for each measure:

Compensation per worker	17.8%
Output per worker	76.0
Implicit (value-added) price	139.5
Unit residual cost	171.4
Unit labour cost	345.6
Change in residual share	825.5
Change in labour share	755.5

Further indication of the degree of variation can be obtained from the accompanying (unnumbered) table showing the industries with the highest and lowest rates of change for the two time periods along with the rate for all manufacturing for the purpose of comparison.

2. A moderately significant association was discerned between increases in production and in labour productivity, at least with respect to production labour. The details appear in Chapter Six. While better technology and improved methods can increase productivity, another significant element is expansion of output to the point of optimum capacity utilization. To expand production beyond that point reduces productivity and increases costs, but this study has no corroborating data on this matter.

3. There was a gradual increase in the relative employment of nonproduction labour and, of course, a corresponding decrease in the employment of production labour. As can be expected, this trend was more pronounced for some industries than for others, and there are industries among those studied where the opposite trend occurred (see Table 5).

4. Compensation per worker increased more, in most of the industries studied, in the 1950's than in the 1960's. And average salary per nonproduction worker increased more than average wage per production worker over both periods. Because of this latter trend and the increase in the proprotion of nonproduction workers employed, the total wages and salaries bill increased more than total wages only.

5. Labour productivity (output per worker) increased more per year in the 1950's than in the 1960's in most of the industries studied. For all manufacturing the decline in the growth rate was almost 40 percent for production labour and one-third for total (production and nonproduction) labour; for the industries studied the decline with respect to production labour averaged a little more than 50 percent and for nonproduction labour a little less than 50 percent.

6. With compensation per worker increasing at a fairly steady rate throughout the entire 1949-1968 period, and the rate of productivity increases falling off in the 1960's, it follows that unit labour cost increased significantly more for most of the industries studied in the 1961-1968 period than during 1949-1960. For all manufacturing the rates of increase in the recent period were three to four times the rates for the full period. (The details can be seen in the table in this chapter, in the summary statistical table for all manufacturing in Chapter Ten, and in Table 33.) When we consider the averages for the industries covered by this study, it can be seen that the increases are even greater, from an average trend rate for production labour of 0.2 percent for production labour over the full period to 1.8 percent over the more recent period, and for total labour, an increase from 0.6 to 1.9 percent (see Table 32).

7. Unit production labour cost increased less over the full period than unit total labour cost, from which it follows that unit nonproduction labour cost increased more. For all manufacturing the annual trend rates were 0.5 and 0.7 percent for production and total labour respectively, and for the industries studied the respective rates averaged 0.2 and 0.6 percent. Over the more recent period there was no longer any marked difference in most cases. For all manufacturing the annual trend rates of increase were 2.0 and 1.9 percent respectively, and for the industries studied the rate averaged 1.8 and 1.9 percent.

8. One observation that should be made at this point is that very few rates of decrease appear in this study with reference to productivity, unit factor costs of production or implicit (value-added) price. Where they do occur, they are noted, but in general it must be said that the 1950's and 1960's were years of rising prices, rising productivity and rising costs. But this is not said to suggest that the rising costs necessarily "caused" the rising prices (which may or may not have been so) but, rather, to point out that our study has been largely concerned with rates of increase; rates of decrease are very much the exception.

9. On the average, unit residual cost increased more than unit labour cost over the full 1949-1968 period for the industries studied and in all manufacturing; the average trend rate of annual increase for the industries studied was 1.4 percent with respect to both production and total labour, contrasting with rates of 0.2 and 0.6 percent for unit labour cost for production and total labour respectively. For all manufacturing, over the full period, the trend rates were 1.3 and 1.2 percent for unit residual cost and 0.5 and 0.7 percent for unit labour cost.

   Over the 1961-1968 period unit residual cost, on the average for the industries studied, increased at slightly lower annual rates than unit labour cost and much less than unit labour cost in all manufacturing but only when unit residual cost is measured in relation to value added by manufacturing; relative to total labour and value added, total activity, the increase in unit residual cost was much closer to that of unit labour cost. For the industries under study, the average rate of increase was 1.6 percent, relative to both production and total labour, when measured against value added by manufacturing, and 1.9 percent relative to total labour and value added by total activity. Unit labour cost for production labour averaged a slightly higher rate of increase, at 1.8 percent, and for total labour, at 1.9 percent, it was greater than the unit residual cost measure related to value added, manufacturing and the same as the measure related to value added by total activity. (Of course, unit labour cost

Highest and Lowest Rates of Change Among the Industries Studied, 1949-1968, 1961-1968

		HIGHEST			LOWEST	
		1949-68	1961-68		1949-68	1961-68
Implicit (value-added) price						
Relative to mfg. activity	Cement manufacturers	+ 4.1%		Rubber industries	−1.2%	
	Saw & planing mills		+ 5.8%	Synthetic textile mills	−1.2%	
	All manufacturing	+ 1.0%	+ 0.9%	Motor vehicles		−5.0%
				All manufacturing	+1.0%	+0.9%
Relative to total activity	Saw & planing mills		+ 5.3%	Motor vehicles		−2.9%
	All manufacturing		+ 1.7%	All manufacturing		+1.7%
Output per worker						
Production labour	Petroleum & coal products	+25.6%		Motor vehicle parts & accessories	+1.0%	
	Motor vehicles		+16.2%	Bakery products		+0.8%
	All manufacturing	+ 5.9%	+ 3.7%	All manufacturing	+5.9%	+3.7%
Total labour	Petroleum & coal products	+20.4%		Motor vehicle parts & accessories	+0.6%	
	Motor vehicles		+17.7%	Cement manufacturers		−0.2%
	All manufacturing	+ 5.8%	+ 3.9%	All manufacturing	+5.8%	+3.9%
Unit labour cost						
Production labour	Motor vehicle parts & accessories	+ 5.1%		Petroleum & coal products	−2.4%	
	Pulp and paper mills		+ 5.5%	Motor vehicle		−4.4%
	All manufacturing	+ 0.5%	+ 2.0%	All manufacturing	+0.5%	+2.0%
Total labour	Motor vehicle parts & accessories	+ 5.9%		Petroleum & coal products	−1.8%	
	Cement manufacturers		+ 6.1%	Motor vehicles		−4.9%
	All manufacturing	+ 0.7%	+ 1.9%	All manufacturing	+0.7%	+1.9%

Highest and Lowest Rates of Change Among the Industries Studied, 1949-1968, 1961-1968

		HIGHEST			LOWEST	
		1949-1968	1961-68		1949-68	1961-68
Unit residual cost						
Production labour	Cement manufacturers	+ 5.1%		Rubber industry	−1.6%	
	Saw & planing mills		+ 6.7%	Motor vehicles		−5.3%
	All manufacturing	+ 1.3%	+ 0.2%	All manufacturing	+1.3%	+1.3%
Total labour (1)*	Cement manufacturers	+ 4.5%		Rubber industry	−1.8%	
	Saw & planing mills		+7.6%	Synthetic textile mills		−5.2%
	All manufacturing	+ 1.2%	−0.1%	All manufacturing	+1.2%	−0.1%
Total labour (2)*	Saw & planing mills		+7.2%	Synthetic textile mills		−5.3%
	All manufacturing		+1.6%	All manufacturing		+1.6%

*(1) relative to value added, manufacturing activity

*(2) relative to value added, total activity

is not measured against value added, as is unit residual cost.) While there was a marked acceleration in the rate of increase of unit labour cost between the 1950's and the 1960's, the rate for unit residual cost, among the industries studied, moved up only slightly. However, there was great variation among the industries with almost as many showing higher rates as showing lower rates, with the result that these contrasting movements tended to offset each other so that for all manufacturing there was no marked trend upward or downward.

10. Unit residual cost increased more than unit labour cost among most of the industries studied over both time periods although the margin was smaller over the more recent, 1961-1968 period. Over 1949-1968 in 13 of the 22 industries studied, unit residual cost showed a higher trend rate of increase than unit labour cost, measured in relation to production labour and total labour, and in two other industries where unit residual cost showed a rate of decrease, it did so at a smaller rate than the rate of decrease for unit labour cost. Over 1961-1968, in 11 of the industries, unit residual cost increased at a higher trend rate than unit labour cost with respect to both production and total labour and when unit residual cost is related to value added by manufacturing; when unit residual cost is related to value added by total activity, 13 of the industries showed greater rates of increase or smaller rates of decrease in unit residual cost than in unit labour cost, relative to total labour.

11. Implicit price with respect to value added by manufacturing activity followed a rather steady trend over the whole period of around 1.0 percent increase per annum. Over the more recent period, 1961-1968, for which the data were available, implicit price relative to value added by total activity moved up at a greater rate, 1.7 percent annually, than the rate for that period relative to manufacturing activity only. Among the industries studied there was great variation in the rates, as shown in the table giving highs and lows at the beginning of this chapter.

    Between 1961 and 1968 the index of implicit price relative to value added by manufacturing increased 6.2 percent and by 10.5 percent when related to value added by total activity. Over the same period the wholesale price index for fully and chiefly manufactured goods increased 15.2 percent and for raw and partly manufactured goods, 17.2 percent. When inputs of raw materials, fuel and energy from outside the manufacturing establishment are taken into account, price increases were much greater. Thus it can be concluded that the cost components for these inputs were moving up at a faster pace over 1961-1968 than unit labour or unit residual cost which are attributable to the manufacturing establishment itself. (It will be recalled that raw material, fuel and energy inputs are included in wholesale price but not in value added price.)

12. Factor shares (that is, the distribution of income from value added apportioned to labour and the residual) changed very little, on the average, among the industries studied and for all manufacturing. Among the former, there was an average reduction of 10.0 percent between 1949 and 1968 in the production labour share and of 4.0 percent in the total labour share. Since the average production labour share was 34.6 percent in 1949, the 10.0 percent reduction means a drop of 3.5 percentage points bringing it down to 31.1 percent, which was not a large enough drop to suggest a significant shift, and the total labour share declined much less. Furthermore, over the more recent period, 1961 to 1968, the labour share in most cases moved up enough to restore at least some of the reduction occurring in the 1950's. This suggests that some shifting of the labour share may be cyclical and that beneath such cyclical fluctuations there is stability. Among the industries studied, the full-period trend rates averaged -0.7 and -0.1 percent per annum for production and for total labour respectively, which become, for 1961-1968, rates of increase of 0.3 percent for both labour categories relative to value added by manufacturing and 0.2 percent for total labour relative to value added by total activity. (Similar shifts can be observed for all manufacturing in the final section of Chapter Ten.) Of course, shifts of some significance did occur in a few industries, which are discussed in the appropriate parts of this report, but they are the exception, not the rule.

    The stability of factor shares demonstrates that, on the average - and there are important exceptions - unit labour and unit residual cost moved sufficiently in line with each other in their relation to movements in implicit (value-added) price to produce such stability. It will be recalled from Chapter Nine and previous exposition that to the extent that unit cost of production relative to one of the factors increases faster than implicit (value-added) price, to that extent that factor's share of value added is increased.[2] This observation may seem inconsistent with other data on distribution of shares. If we look at national income data, it will be seen that, as a proportion of gross national product, wages, salaries and supplementary labour income increased from 49.8 percent in 1949 to 55.1 percent in 1968, a 10.6 percent rise.[3] However, much (if not all) of this rise is a result of the decline of agriculture and small business as sources of income; accrued net income of farm operators from farm production accounted for 7.5 percent of national income in 1949 and only 2.1 percent in 1968, a drop of 72.0 percent, while net income of nonfarm unincorporated business, including rents, declined from 10.1 percent to 5.9 percent, a fall of 41.6 percent. If these shares decline, other shares must increase. But if we confine our analysis to the commercial nonagricultural sector of the economy, there is no evidence of important changes in factor shares;[4] and the industries examined in this study are all part of that sector.

Some Other Highlights

Certain other findings are worthy of mention but probably do not merit the designation of "principal findings".

Unit labour cost followed a much more irregular pattern than either compensation or output per worker. We know that compensation moved along a rather steady trend path and while its rate of change was affected by economic and other circumstances, this was less the case than with labour productivity. The latter, we have suggested, is affected by rate of utilization of plant capacity which, of course, fluctuates with general conditions of demand in the economy. Hence we can expect greater instability in the performance over time of productivity. (This can be considered a corollary of principal finding number two.). Unit labour cost is the resultant of productivity and compensation per worker and the fluctuations in productivity were accentuated rather than dampened when combined with movements in labour compensation. An observation that can be made at once is that generalizations about trends in unit labour cost are apt to be misleading in view of its instability over time.

Unit residual cost did not behave much differently, whether related to production labour or total labour. However, when all manufacturing is taken as a unit, increases over both 1949-1968 and 1961-1968 were greater when the measure was relative to production and not total labour. This is because the cost of nonproduction labour is part of unit residual cost relative to production labour (that is, only production labour cost has been removed), and nonproduction labour cost increased more than production labour cost and also more than nonlabour cost. (See principal findings number 3, 7 and 9.)

Employment increased more between 1949 and 1968 for all labour in all manufacturing, at 32.8 percent, than for production labour only, at 27.2 percent. Both increases were less than the 44.9 percent employment increase in the industrial composite which consists of: forestry, mining, manufacturing, construction, transportation, storage and communication, public utilities, trade, finance, and service. The fact is generally known that manufacturing is no longer one of the principal sources of employment growth in our national economy. Which is not to say that some manufacturing industries have not been the source of many new jobs; for example, among the industries covered by our study is motor vehicle parts and accessories in which total employment in 1968 was 162.1 percent greater than in 1949. On the other hand total employment in cotton yarn and cloth mills was 41.9 percent less.

The Main Conclusion

While this study was undertaken for many reasons, the interested layman will look to it for an answer to the question: have wages been pushing up prices? We would not presume, even on the basis of the multitudinous facts assembled in the course of this project, to offer a definitive answer to such a question. Indeed, we cannot offer a final answer even for the industries the research has covered. But we shall offer a partial and tentative answer.

Throughout this report it has been repeatedly stated that evidence of rising costs is not, *per se*, proof that rising prices were caused by the rising costs. The debate on whether inflation is caused by excessive demand (demand pull) or excessive rises in costs (cost push) continues to rage. It is beyond the purview of this study to offer an opinion in favour of one side or the other. However, we can offer an opinion on the behaviour of costs in relation to prices based on our findings.

For the sake of argument, if we assume for the moment that costs do push up prices, we would offer these observations:

1. Cost pressures on prices, if they did exist, operated mostly over short time periods, a few years at a time, over the 19 years of our study. Very few, if any of the unit cost series show a steady year-by-year rise without some reductions from time to time; however, there were also periods of acceleration.

2. Since wholesale prices (as measured for our purposes by the industry selling price indexes) mostly rose more than implicit (value-added) price over the period, the rising cost of raw material, fuel and energy imputs would have to be "blamed" even more for rising prices than the costs of labour and capital (in its various forms) entering into the creation of value added.

3. On the average, there were not great differences in the relation of unit labour and unit residual cost to price. This has already been considered at some length (see principal finding number 12) and the details need not be elaborated once more. The point is that if "blame" is to be attached to costs in the rising prices of manufactured goods, at least for the 1949-1968 period, the blame would have to be laid about equally on labour and the residual factor, along with raw material and other input costs, mentioned above.

4. Since this study has not been able to decompose the residue, we cannot say how much of any increase in unit residual cost is due to higher interest charges on funded debt, higher rents, depreciation charges on fixed capital, other increases in fixed costs, research and advertising, and so on, and how much may be due to higher profits per unit of output.

In short, to the extent that rising prices are caused by the pressure of rising costs more than or rather than by pressure of increasing demand, if we look at the 19-year experience covered in this study, labour and nonlabour costs within the establishment are, on the average, equally to blame. It is true that over some periods within 1949-1968 unit labour cost rose more than unit residual cost and vice-versa. But all time periods used in such analysis are, to some extent, arbitrary. Bearing this in mind as well as the variation in experience industry by industry and from year to year and the nature of whatever trend was evident, we can offer this view. It is not inconsistent with the fact that for some industries (perhaps for most of them) for some years, one type of unit cost rose much more than the other. Finally, we must refer once again to the apparently greater increase in unit raw material and other input costs (inputs, that is, from outside the establishment) compared to labour and residual costs. Of course, the higher costs of raw materials, etc. may reflect higher unit labour and residual costs of extraction or processing or may reflect strong demand conditions, or a combination of the two; but we have not examined the industries responsible for supplying materials except to the extent that any of the manufacturing industries we have studied are sources of supply to any of the other industries.

Some Thoughts on Future Research

No study of something as complex as productivity, costs and prices can hope to cover more than a small part of the subject. This study is indeed incomplete. Obviously, by the time it is published, it is out of date because more recent data have since become available. We contend that this is not a serious shortcoming in a study, like this one, of medium to long-term trends, such as will be found over the 19 years from 1949 to 1968. A more serious shortcoming is in some of the omissions in our analysis of those years.

The reader will have his own views as to the most serious shortcomings of this study, but we offer a small list of some which, it is hoped, future research (either ours or someone else's) might rectify at least in part:

1. While trend rates were computed for 1949-1968 and 1961-1968, no computations were made separately for 1949-1960. This is unfortunate because where there are marked differences between the 1949-1968 and 1961-1968 rates, it follows that the reason is that there is an even greater difference between 1949-1960 and 1961-1968. This omission was not caused by a lack of the necessary data but is a result of time constraints; to have added such computations would have further delayed completion of this study.

2. While computations were made with respect to production labour and total labour (the latter comprising production and nonproduction labour), none or, at least, very few were made with respect to nonproduction labour separately. In view of the increasing importance of the salaried labour force which includes professional, semi-professional, technical and managerial personnel, this omission is also unfortunate. Most of the necessary data were available but the computations were not made for the same reason given concerning the first item, above.

3. The basic labour input we have used is the worker rather than manhours paid for. The reasons for this are given in Chapter Five and for those reasons it is believed that manhours are not as good a measure as number of workers. But this is not to deny the usefulness of the manhours measure for some purposes. Future studies of productivity would be likely to make greater use of manhours data where they are available.

4. We had to use a higher aggregation of industrial activity in some cases than we would have preferred. This was occasioned by limited availability of data at a more disaggregated level. It would be better to deal separately with tire and tube manufacturing and rubber footwear manufacturing than to have them subsumed under "rubber industries"; similarly with men's, and boys' clothing and women's clothing, etc. that fall into "clothing industries". It would have been better to deal separately with petroleum refineries than to cover them under "petroleum and coal products" but to cover the 19 years we chose, data at this degree of disaggregation were just not available in these and certain other cases. Some of this problem can be overcome in future research because more detailed data are available for recent years.

5. The cost of raw material, fuel and energy inputs has been treated very lightly in this study because it enters into wholesale price but not value-added price; furthermore, their costs do not relate to activities within the establishments making up each industry. However, it is desirable to extend the analysis related to value-added price and its components to cover wholesale price and the costs entering at that level. Conceptually, this is possible (one can estimate a unit cost per unit of raw material just as one can do so per unit of labour) but data limitations may prevent its realization for some time.

6. Unit residual cost is an important object of our analysis. While this study does not claim any originality in introducing this measure, the fact is that it has not, to our knowledge, been used in any other Canadian studies. The notion of residual cost suffers from the fact that it has many elements which are mentioned above under item 4 of "The Main Conclusion", but could not be disaggregated. Many difficulties stand in the way of breaking down the principal components of the residual, but it is highly desirable that an attempt be made to do so. The relation

of profits to productivity, costs and prices is a very important consideration; similarly, with respect to various kinds of overhead expenses, such as interest on short-term and long-term debt, rent on buildings and equipment, depreciation charges and so on.

The data offered in this study suffer from the limitations just mentioned and other limitations as well. However, they provide a basis for some judgments, however tentative, on the relation of productivity, wages, salaries, costs and prices. This study is not an isolated one. We have made many references to studies by Statistics Canada and the Economic Council of Canada as well as other research. One purpose of this report is to complement the other research to broaden and deepen our basic knowledge in this field.

Footnotes

[1]One of the landmark studies of productivity makes a point which applies to our study not only with respect to measures of productivity change, but other measures as well:

"The fact that most of the individual-industry indexes are subject to greater error than the national indexes partly accounts for the differences among industries in average rate of productivity increase. It also contributes to the greater temporal variability of the industry indexes as compared with the fluctuations of the overall indexes. But these deficiencies can hardly account for all the variation in average rate or for all the differences in degree of fluctuation. Technological development and the other immediate factors that impinge on labour, capital or total productivity often affect different industries at different times and in different degrees. Some of the time and space variation in productivity increase must be 'real'." — John W. Kendrick: *Productivity Trends in the United States*, p. li of introduction by Solomon Fabricant; National Bureau of Economic Research, No. 71, General Series, 1961.

[2]See Footnote 4, Chapter Nine. Since, by definition, implicit (value-added) price change is the weighted sum of change in unit labour and unit residual cost, if one exceeds implicit price, the other must proportionately fall short of it, which means, as demonstrated in the footnote just cited, an increase in the one factor share and a decrease in the other.

[3]See Canada Department of Finance: *Economic Review*, April 1972, Reference Table 10, page 87; or Statistics Canada publications on national income and expenditure.

[4]See Canada Department of Labour: *The Behaviour of Canadian Wages and Salaries in the Postwar Period*, Table 2; Nov. 1967. See also P. Kumar: cited in footnote 15, Chapter Nine.

APPENDIX A

Adjustments to Census of Manufacturing Data Because of Changes in Classifications and Definitions

The revisions to the Standard Industrial Classification, the introduction of the new definition of an establishment, and of the total activity concept are described in Chapter Four. Each of these three revisions brought about changes in the data from the Census of Manufactures. This appendix sets forth the formula used for adjusting the data published since the statistical revisions took effect; the adjustments were necessary to maintain continuity with the data published for the years preceding the revision.

The revised industry classification and the new definition of establishment were introduced simultaneously, having a combined effect on the data at one time. Data were provided for the years 1957, 1958 and 1959 on the old and new basis so that adjustment factors for each series and each industry could be worked out, which in effect represented the relative difference between the data on the old and new basis. A third revision, related to introduction of the total activity concept, was introduced in 1961, with the figures for that year only being available on the basis of the first two revisions only and on the basis of all three revisions.

The formula for the adjustment and an example follow, using hypothetical figures for employment. (The figure of 175 represented by E_n could stand for 175,000 employees.) Similar adjustments can be computed for payroll (wages, wages and salaries) and value added, manufacturing. (No adjustments apply to value added by total activity because it was introduced in 1961 as a new measure.)

$$E_n = E_n^{**} \underbrace{\left(\frac{\bar{E}^*_{57-59}}{\bar{E}_{57-59}} \right)^{-1}}_{\text{I}} \times \underbrace{\left(\frac{E^{**}_{61}}{E^{*}_{61}} \right)^{-1}}_{\text{II}}$$

E_n –the value for employment for year n after being adjusted to eliminate the effect of changes in the Standard Industrial Classification, new definition of the establishment and introduction of total activity.

E^{**}_n –the value for year n as published based on all revisions in the classification code, new definition of establishment and new total activity concept.

$\bar{E}_{57-59}$ –the average value for the years 1957 to 1959 inclusive on the basis of the old, unrevised classification code and definition of establishment.

$\bar{E}^*_{57-59}$ –the average value for 1957 to 1959 inclusive on the basis of the initial revisions (that is, of the classification code and definition of the establishment).

E^*_{61} –the value for 1961 on the basis of the initial revisions.

E^{**}_{61} –the value for 1961 on the basis of all revisions.

Example:

$$E_n = 175 \left(\frac{140}{155}\right)^{-1} \times \left(\frac{160}{150}\right)^{-1}$$

$$= 175 \times (1.107 \times .9375)$$

$$= 175 \times 1.038$$

$$= 181.650$$

E^{**}_n 175

$\bar{E}^{*}_{57-59}$ 140

$\bar{E}_{57-59}$ 155

E^{**}_{61} 160

E^{*}_{61} 150

The part of the formula marked by I represents computation of the first adjustment factor for covering changes occasioned by the new classification code and definition of establishment. The part represented by II represents computation of the adjustment factor to cover changes occasioned by introduction of the total activity concept.

In the example, the first adjustment factor is 1.107 and the second .9375. What the first factor means is that the revised data were .9032 of the unrevised data, and to restore the revised data to value based on the old codes, the revised data must be multiplied by the reciprocal of .9032, which is 1.107. In the case of the second adjustment factor, the adjusted value is greater than the unadjusted value; the ratio of the adjusted to the unadjusted is 1.067, the reciprocal of which is .9375. The final adjustment factor, the product of the two, is 1.038.

Only adjustment factor I was applied to the data for 1960 and 1961, while the combined factor was applied to data for 1962 and after. Data for 1957 to 1959 inclusive were available so that there was no need to use the data on the new basis and to revise it; similarly for data for 1961 and the final adjustments.

The two adjustment factors and the combined one are shown for each series of data for each industry in the following table.

Adjustment Factors, Manufacturing Data

	Employment – production labour			Employment – total labour			Wages – production labour			Wages & salaries – total labour			Value added manufacturing activity		
	I	II	Combined	I	II	Combined	I	II	Combined	I	II	Combined	I	II	Combined
Slaughtering and meat processors	1.014	1.002	1.016	1.020	.934	.952	1.019	1.000	1.019	1.028	.935	.961	1.105	.988	1.092
Bakery products	1.022	1.580	1.614	1.019	1.066	1.086	1.018	1.627	1.656	1.016	1.036	1.052	1.019	1.029	1.049
Distilleries	1.010	1.012	1.022	1.015	.901	.915	.987	1.012	.999	1.018	.877	.893	1.005	1.015	1.020
Breweries	1.000	1.015	1.015	1.000	.799	.799	1.000	1.000	1.000	1.000	.793	.793	1.006	1.051	1.057
Tobacco products	1.000	1.003	1.003	1.000	.909	.909	1.000	1.000	1.000	1.000	.893	.893	1.018	1.013	1.031
Rubber industries	1.000	.998	.998	1.000	.955	.955	.999	1.004	1.003	.999	.967	.966	.973	1.010	.983
Cotton yarn and cloth mills	1.001	1.016	1.017	1.001	.999	1.000	1.000	1.016	1.016	1.000	1.005	1.005	.996	1.005	1.001
Synthetic textile mills	1.005	.999	1.004	1.018	1.009	1.027	1.011	.918	.928	1.020	1.010	1.030	1.022	1.015	1.037
Clothing industries	1.017	1.004	1.021	1.018	.941	.958	1.020	1.000	1.020	1.023	.916	.937	1.029	.996	1.025
Furniture and fixtures	.973	1.006	.979	.973	.994	.967	.984	1.005	.989	.981	.965	.947	.979	1.006	.985
Saw and planning mills	1.039	1.002	1.041	1.068	.971	1.037	1.034	1.000	1.034	1.037	.965	1.001	1.080	.984	1.063
Pulp and paper mills	1.000	.998	.998	.998	1.031	1.029	.998	1.000	.998	1.002	.989	.991	.976	1.002	.978
Printing, publishing & allied industries	.999	1.005	1.004	.999	.968	.967	.999	1.003	1.002	1.001	.954	.955	1.002	.988	.990
Iron & steel mills	.989	1.004	.993	.993	.994	.987	.984	1.003	.987	.990	.997	.987	.976	1.036	1.011
Agricultural implements	1.046	1.003	1.049	1.047	1.043	1.092	1.033	.998	1.031	1.035	1.070	1.107	1.033	.982	1.014
Motor vehicles	.904	.998	.902	.907	.869	.788	.923	1.000	.923	.924	.862	.796	.946	1.009	.954
Motor vehicle parts & accessories	1.168	.999	1.167	1.176	1.011	1.189	1.148	1.000	1.148	1.155	1.007	1.163	1.135	1.014	1.151

Adjustment Factors, Manufacturing Data

	Employment — production labour			Employment — total labour			Wages — production labour			Wages & salaries — total labour			Value added manufacturing activity		
	I	II	Combined	I	II	Combined	I	II	Combined	I	II	Combined	I	II	Combined
Smelting & refining . .	.985	1.000	.985	.985	.978	.967	.984	1.000	.984	.984	.980	.964	.816	1.000	.816
Electrical products . . .	.896	1.012	.907	.907	.975	.884	.900	1.000	.900	.915	.963	.881	.945	1.000	.945
Cement manufacturers	1.000	1.000	1.000	1.000	.867	.867	1.000	1.000	1.000	1.000	.867	.867	1.001	1.000	1.001
Petroleum and coal products	1.245	1.007	1.254	1.174	1.214	1.425	1.233	1.008	1.243	1.152	1.262	1.454	2.375	1.004	2.385
Chemicals	1.022	1.004	1.026	1.021	.869	.887	1.014	1.002	1.016	1.016	.854	.868	1.034	.996	1.030
All manufacturing . . .	1.009	1.032	1.041	1.013	.935	.947	1.008	1.032	1.040	1.009	.918	.926	1.026	1.024	1.051

I and II represent adjustment factors I and II and the combined factor is the product of I and II.

APPENDIX B*

Assessing the Statistical Validity of the Implicit Price Equations

The basic "implicit price" identity is expressed as follows:

$$(1)\quad \frac{W}{Y}\left(\frac{w_0}{va_0}\right)+\frac{R}{Y}\left(1-\frac{w_0}{va_0}\right)\equiv\frac{VA}{Y}\text{ or }P$$

When we use actual data for each year, the two components in the left hand side add up for each year to the component in the right hand side of the identity (1).

However, if we want to eliminate undesirable short-term fluctuations, we can calculate the long-term trend of the variables W/Y, R/Y and VA/Y with the least squares method and obtain the calculated values $(W/Y)^*$, $(R/Y)^*$ and $(VA/Y)^*$.

By doing so, the basic identity breaks down and the mathematical expression can be transformed into a probabilistic equation. In such a case, the equation can be written as follows:

$$(2)\quad \left(\frac{W}{Y}\right)^*\left(\frac{w_0}{va_0}\right)+\left(\frac{R}{Y}\right)^*\left(1-\frac{w_0}{va_0}\right)=\left(\frac{VA}{Y}\right)^*+D$$

where D takes any positive or negative values for all years, and represents the difference or error created after each trend is calculated.

Let us now transform the right hand side of the equation (2) in terms of probability intervals, to obtain the following statistical expression:

$$(3)\quad P_r\left[\left(\frac{VA}{Y}\right)^*-kS\leq\left(\frac{VA}{Y}\right)\leq\left(\frac{VA}{Y}\right)^*+kS\right]=t_\alpha$$

where S is the standard error of estimate calculated as follows:

$$S=\sqrt{\frac{\Sigma Y^2-a\Sigma Y-b\Sigma XY}{N}}\cdot\sqrt{\frac{N}{N-2}}$$

and where $k=1$ when $t_\alpha=0.6827$

$k=2$ when $t_\alpha=0.9545$

$k=3$ when $t_\alpha=0.9973$

This expression (3) has the following meaning: at the desired confidence level t_α to which is associated a value k (confidence coefficient) representing the number of standard errors (i.e. the probabilistic field), the probability that VA/Y be included inside the interval between $(VA/Y)^*-ks$ and $(VA/Y)^*+kS$ is t_α

To illustrate, it means that at the level of $k = 2$ (i.e. inside the probabilistic field of 2 standard errors around the calculated trend (VA/Y)* there are from 95 to 96 chances out of 100 that every value of VA/Y for all years falls into the confidence interval between the calculated values of the trend (VA/Y)* $-2S$ and those of the trend (VA/Y)* $+2S$.

The value of t_{α} is almost sure to be different for the trend rates for VA/Y, W/Y, and R/Y and the greater the difference, the more likely there is to be a difference between the values in columns A and B of the implicit (value-added) price equations appearing in each industry section in Chapter Ten; that is, the greater will be the value of D in equation (2).

Footnote

*This appendix was prepared by Mr. Réal Parent.

APPENDIX C*

Statistical Significance of Linear and Nonlinear Trend Values

Among the statistical series for which linear trends have been calculated, some of them show poor fits. An estimate of the significance levels (0.95 and 0.99) is made based on the goodness-of-fit ratio (R) in such a manner that any series having a critical value lower than the significance levels is picked up in order to calculate nonlinear trends.

From the Student's test formula

$$t_\alpha = \frac{R\sqrt{N-S}}{\sqrt{1-R^2}}$$ R can be isolated to give

$$R = \frac{t_\alpha}{\sqrt{t_\alpha^2 + N-2}}$$ where R can be

used as a critical value of goodness-of-fit and can be alternatively designated as R^*. N-2 is the number of degrees of freedom in which N represents the number of observations, and t_α is the desired level of significance (0.95 or 0.99 or else); in fact, the 0.99 level has been chosen because only at that level was it indicated that a different time series fit was appropriate for some industries. The test consists of calculating, at a given level, the critical value R^* and comparing it with the calculated value R of the linear trend of a series. When $R>R^*$, the linear trend is appropriate; when $R<R^*$, it is inappropriate and a nonlinear trend should be attempted.

This test was applied to a sample of selected series with 17 degrees of freedom. The level, $\alpha = 0.99$ having been chosen, t_α is then equal to 2.57.[1], and the estimated critical value R^* is 0.529. (If the level, $\alpha = 0.95$ is chosen, R^* is 0.388). Those series that showed an R smaller than 0.529 were picked up and an attempt was made to calculate nonlinear trends on them.

The results are shown in Table C1 where both linear and nonlinear trend values are compared, broken down by series and by categories of labour; and in Table C2, with the related equations (only the right side of the equation being shown, Y being assumed, as usual, as the dependent variable).

TABLE C1

Unit labour cost series

1 - Production workers, value added, manufacturing activity (1949-1968)

Industry	Linear trend		Nonlinear trend	
	S	R	S	R
Rubber industries	.056	.160	.045	.680
Cotton yarn and cloth mills	.092	.518	.060	.849
Saw and planing mills	.071	.176	.012	.903
Iron and steel mills	.076	.164	.070	.510
Agricultural implements	.187	.153	.131	.739
Motor vehicles	.108	.012	.078	.736
Smelting and refining	.140	.461	.018	.940
Cement manufacturers	.113	.475	.062	.889

2 – Total labour, value added, manufacturing activity (1949–1968)

Slaughtering and meat processors	.089	.496	.075	.720
Distilleries	.060	.461	.033	.882
Breweries	.050	.206	.037	.719
Cotton yarn and cloth mills	.107	.183	.060	.855
Saw and planing mills	.075	.021	.040	.864
Iron and steel mills	.089	.462	.083	.627
Agricultural implements	.238	.191	.116	.892
Motor vehicles	.142	.049	.074	.857

Unit residual cost series

1 – Production workers, value added, manufacturing activity (1949–1968)

Industry	Linear trend		Nonlinear trend	
	S	R	S	R
Synthetic textile mills	.104	.351	.055	.884
Saw and planing mills	.154	.187	.116	.690
Pulp and paper mills	.106	.315	.074	.629
Agricultural implements	.149	.449	.143	.574
Motor vehicles	.262	.224	.124	.842
Electrical products	.049	.306	.040	.631
Petroleum and coal products	.385	.483	.213	.890
Chemicals	.036	.355	.032	.649

2 – Total labour, value added, manufacturing activity (1949–1968)

Synthetic textile mills	.145	.312	.074	.888
Saw and planing mills	.192	.107	.128	.763
Pulp and paper mills	.109	.122	.092	.621
Agricultural implements	.229	.159	.224	.388
Motor vehicles	.243	.249	.135	.861
Electrical products	.054	.247	.048	.530
Petroleum and coal products	.433	.504	.224	.888

TABLE C2

Unit labour cost series

1 – Production workers, value added, manufacturing activity

Rubber industries $.860 + .162X - .031X^2 + .002X^3 - .00005X^4$
Cotton yarn and cloth mills $.921 + .096X - .014X^2 + .0005X^3$
Saw and planing mills $-.02 + .037X - .004X^2 + .0001X^3$
Iron and steel mills $.920 + .075X - .008X^2 + .0002X^3$
Agricultural implements $1.252 + .091X - .004X^2$
Motor vehicles $1.172 - .056X + .002X^2$
Smelting and refining $.066 + .082X - .008X^2 + .002X^3$
Cement manufacturers $.945 + .180X - .021X^2 + .0007X^3$

2 – Total labour, value added, manufacturing activity

Slaughtering & meat processors $.962 + .110X - .010X^2 + .0003X^3$
Distilleries $.898 + .079X - .008X^2 + .0002X^3$
Breweries $.994 + .063X - .007X^2 - .0002X^3$
Cotton yarn and cloth mills $.842 + .159X - .020X^2 + .0006X^3$
Saw and planing mills $.911 + .117X - .014X^2 + .0004X^3$
Iron and steel mills $.910 + .091X - .009X^2 - .0002X^3$
Agricultural implements $.818 + .327X - .029X^2 + .0007X^3$
Motor vehicles $.777 + .085X - .004X^2$

Unit residual cost series

1 – Production workers, value added, manufacturing activity

Synthetic textile mills $1.271 - .184X + .019X^2 - .0006X^3$
Saw and planing mills $1.401 - .078X + .003X^2$
Pulp and paper mills $1.387 - .082X + .101X^2 - .0003X^3$
Agricultural implements $.771 + .127X - .013X^2 + .0004X^3$
Motor vehicles $1.540 - .302X + .038X^2 - .001X^3$
Electrical products $1.063 - .017X - .001X^2$
Petroleum & coal products $.574 - .399X - .027X^2 - .0005X^3$
Chemicals $1.100 - .045X + .008X^2 - .0004X^3$

2 - Total labour, value added, manufacturing activity

Synthetic textile mills $1.352 - .256X + .027X^2 - .0008X^3$
Saw and planing mills $1.469 - .106X - .005X^2$
Pulp and paper mills $1.472 - .124X + .015X^2 - .0004X^3$
Agricultural implements $.859 + .015X - .005X^2 + .0002X^3$
Motor vehicles $1.701 - .385X + .046X^2 - .001X^3$
Electrical products $1.083 - .020X + .0009X^2$
Petroleum & coal products $.495 + .447X - .030X^2 + .0006X^3$

Footnotes

[1]The figure is drawn from a table showing Student's t values, derived from R.A. Fisher and F. Yates, *Statistical Tables for Biological, Agricultural and Medical Research,* Table III, 5th edition, Oliver and Boyd Ltd., Edinburgh.

*This appendix was prepared by Mr. Réal Parent with minor revisions by the principal author.

APPENDIX D

Unit Residual Cost Determined by Current Compared with Base Weights - a Mathematical Note

From our identity on implicit (value-added) price,

$$\frac{W}{Y}\left(\frac{w}{va}\right)+\frac{R}{Y}\left(1-\frac{w}{va}\right)\equiv\frac{VA}{Y}$$

it follows that

$$\frac{R}{Y}=\frac{VA/Y-W/Y\left(\frac{w}{va}\right)}{1-\frac{w}{va}}$$

The value of R/Y is determined in part by the labour weight, w/a. If the $\left(\frac{w}{va}\right)_0 \neq \left(\frac{w}{va}\right)_1$ the latter being the current weight, then R/Y, derived from current-weighted data will not be the same as R/Y derived from base-weighted data.

If $\left(\frac{w}{va}\right)_0 < \left(\frac{w}{va}\right)_1$ then $(R/Y)_0 > (R/Y)_1$

As explained in the text, change in the labour share can be determined by the formula,

$$\frac{W}{Y}\left(\frac{VA}{Y}\right)^{-1}$$

which works out to W/VA.

If $W/Y > R/Y$, it is because $W > R$, Y being common to both. Therefore, if $(R/Y)_1 < (R/Y)_0$ so that $(W/Y)_1 > (W/Y)_0$, it follows that

$$\frac{R_1}{R_0} < \frac{W_1}{W_0} \quad \text{and} \quad \left(\frac{W}{VA}\right)_1 > \left(\frac{W}{VA}\right)_0$$

For any year (indicated here by subscript 1), if the current weight is greater than the base weight, the current-weighted index of unit residual cost will be less than the base-weighted index; at the same time, the index of change in the residual share of value added will be less (or, as demonstrated above, the index for the labour share will be greater).

If the current weight is less than the base weight, the opposite results apply.